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RESUSCITATION FROM ELECTRIC SHOCKS.

We print elsewhere a valuable paper by Dr. Augustin H. Goelet, late president of the American Electro-Therapeutic Association and one of the leading authorities on electro-therapeutics in the world, which gives a detailed account of the treatment to which a patient shocked by electricity should be subjected. In order to more clearly teach the manipulations of the method for reviving the subject, our artist, under the direction of Dr. Goelet, has prepared illustrations which make an understanding of the processes very simple. It will be noted that Dr. Goelet refers to the treatment as being similar to that employed for reviving a person from an exaggerated faint, rather than the treatment usually applied to the drowned. There is, however, much resemblance between the methods, and the phrase of D'Arsonval is useful in fixing the general principles of the remedy to be applied. The endorsement which Dr. Goelet gives to the statements of D'Arsonval adds to the necessity of those engaged in electrical pursuits becoming familiar with the proper system of treatment, and which they now have placed before them. In order that the directions may be in a form most convenient for preservation and reference, we shall reprint the article on a separate sheet and a copy may be had by any of our readers upon application.

COST OF ELECTRICAL ENERGY.

In this issue we reprint the concluding section of Mr. E. Ray Stevens' paper on "Electric Lighting in England," which has dealt very thoroughly with that subject and particularly with the cost of generating current for lighting. While the various data of the cost of production are of much value, yet the differences in the figures given are considerable, which perhaps are to be partly ascribed to different methods of accounting, notwithstanding the Board of Trade requirements of uniformity, or to the abnormal conditions naturally prevailing in new stations, though a knowledge of the load factor would doubtless clear up some of the contradictions. The table given in the present section of the average actual cost per kilowatt-hour of generating electric current for lighting in British stations, is of much interest, and gives support to the conclusions we have arrived at in these columns. It will be seen that the average cost per B. O. T. unit (kilowatt-hour), exclusive of interest, depreciation and sinking fund charges, is 8.35 cents for private stations, which would bring the total cost to over 10 cents per kilowatt-hour, or over 7½ cents per horse-power-hour. It is difficult to see any reason for the lower cost given for generating current in municipal stations—6.06 cents per kilowatt-hour—and we are inclined to think that the American practice of forcing a favorable balance sheet to make a good showing for municipal stations is not unknown in Great Britain.

LA LUMIERE ELECTRIQUE.

What we have feared for a long time has now become a fact, for we learn with regret that the publication of our highly esteemed French contemporary, "La Lumiere Electrique," has been suspended. Our suspicions were aroused again lately by the failure to receive any issues later than that of August 4, and they have been confirmed by the receipt of a formal notice that the publication will be suspended awaiting a reorganization of the financial department. It has been conducted at a loss of about $14,000 a year, during a period of many years, the funds having been furnished by its director, Dr. Cornelius Herz, of whom it may be truly said that he loved his noble journal, keeping up its high standing and excellent appearance at a sacrifice which few men would be willing to make, year after year, for the cause of science. The journal, con-

ducted formerly by the late Count du Moncel, has always retained its high rank as the leading purely scientific electrical journal of the world, and it is undoubtedly due to its having limited its field too exclusively to purely scientific matters that it did not succeed financially. In our opinion the proper place for the publication of valuable but purely scientific papers on electrical subjects is in some of the standard journals devoted to pure science and physics in general. An electrical journal of the present time should devote itself more to the important industrial applications of electricity, at the same, time keeping its readers informed of the *results* of the purely scientific researches in the electrical field, giving, at the same time, references to the publication of such researches in the physical journals. We heartily wish "La Lumiere Electrique" success in the reconstruction of its financial department, and hope to find that its publication will be resumed, but we venture to predict that a somewhat different policy will have to be adopted. It is curious to find that the same person who has shown such substantial devotion to pure science and to his highly appreciated journal, has such an unenviable reputation in his former home, America, and has voluntarily banished himself from France to avoid arrest and trial for his improper connection with the Panama Canal scandal in France.

LOCOMOTIVE vs. STATIONARY ENGINES.

One of the maxims of war is not to underrate your antagonist, and it is a maxim that applies as well in other vocations. The victories of electricity have heretofore been so easily won that the confidence thereby instilled is apt to cause the real strength of an adversary to be under-estimated. Much, for example, has been said of the great inefficiency of locomotive engines as compared with stationary types, and many of the predictions in regard to steam traction being displaced by electricity have been based upon this assumption. A French engineer, M. Desdouits, has recently published the results of a thorough investigation of the relative economy of locomotive, stationary and marine engines from numerous dates of tests of the various types. From the comparisons of water consumption he concludes that the locomotive engine, either of the usual form with a single valve, or of the improved form working compound, or with Corliss valves, is susceptible of as great economy as the best stationary or marine engines having the same system of steam distribution, and that working with a condenser it has a marked advantage. He finds that the consumption of water in a locomotive with a single valve under favorable conditions as to cut-off and pressure, can be lowered to 24.25 pounds per I. H. P., 23.15 pounds being a limit corresponding to the most perfect condition of regulation. The compound system permits the consumption to be lowered to 22 pounds, and the Corliss system used on the State Railway of France gives the same figure. Under the usual conditions of construction and working of locomotives, it is stated that the consumption of water varies from 24.25 to 26.5 pounds, and, where a high power is required at moderate speeds, it may rise to 28.75 pounds or even more under exceptional circumstances. We doubt if these results are exceeded in our power stations of to-day, though they do not equal those of published tests of stationary engines. It may be remarked, however, that such tests are usually to be received with much caution, for the great differences in the performance of the same type of engine as reported by different experts, cannot be accounted for on rational grounds, and justify the suspicion with which the data of engine efficiency trials are in general regarded by engineers.

NATIONAL AND MUNICIPAL OWNERSHIP IN ENGLAND.

We have before referred to the measures being undertaken in England toward bringing long-distance telephony under the control of the general government, and one of our London contemporaries enables us to give some further particulars. It seems that the original licenses to telephone companies were only for restricted areas, and did not permit long-distance or inter-town lines. In 1884, however, such lines, called trunk lines in England, were authorized, but recently an agreement has been perfected, though not yet ratified by the government, through which the companies will relinquish their concessions to all lines outside of exchange areas, receiving in payment a sum 10 per cent. in excess of the estimated cost price, the Post Office to take possession after July 1 of next year. In exchange areas where trunk and subscribers' lines cannot well be separated, the Post Office will enter into a partnership arrangement for common maintenance. It is predicted that when the measure comes before the House of Commons for final action, a strong effort will be made to authorize the municipal ownership of telephone exchanges, with some prospect of success. The doctrine of municipal ownership seems to be strongly entrenched in Great Britain; the great majority of new lighting stations have been erected by municipalities, and the recently organized London County Council would, we fear, be considered dangerously socialistic in this country from its tendencies toward the principles of which the cases referred to are applications. The business administration of English municipalities renders such experiments there of value, for the results, whether favorable or unfavorable, will be logical ones and not subject to complication from political corruption. The outrageous interference of corrupt politics in so many of our municipal projects of a similar nature should cause us to hesitate to adopt the English idea, which is administered upon the same business principles that would guide a private owner, and is otherwise doomed to failure. If an example is wanted of the evils that may spring from following an idea, however good it may have proved to be elsewhere, without consideration of the conditions involved, the case of Detroit may be pointed out. The establishment of a municipal plant there has apparently been the occasion for an orgie of corruption, and if the plant is ever finished it promises to be merely a constant source of venality.

COMPARING DRY CELLS.

In discussing some recent comparative tests of dry cells of different makers, a London contemporary highly endorses the conclusions of the expert to use, as a unit of comparison, the *bulk* of the cells. We fully recognize the difficulty in selecting some unit of comparison for such cells, as also for cells of the Leclanche type in general, but we cannot agree entirely with our contemporary that "no other test than that of taking cells of a similar size can be really of value." For purely scientific researches it may be that this unit is as good as any other, or perhaps the best of a poor lot to choose from, but as the practical results are really what such tests are intended to determine, it seems to us that a different unit of comparison might be more satisfactory, at least to the users and purchasers of the cells, who, after all, are those for whom such reports are usually intended. In all but a few cases there is generally plenty of room for placing such cells, and their bulk is therefore of little importance to the user, at least within reasonable limits; he is interested chiefly in two factors, the first cost of the cell and the operation, including its behavior, life, capacity, cost of maintenance, etc. A comparison of two cells, to be of interest to the purchaser, should therefore be based on the cost as a unit, and only in comparatively few cases on the bulk or weight. If one cell behaves much better than another or has a greater output, it will certainly be preferred by the purchaser, if the price is the same, notwithstanding that its bulk or weight may be somewhat greater. If one maker chooses to use a thicker zinc or more solution, and is willing to sell the cell for the same price, why should he not get the credit for it, instead of having his cell pronounced inferior, as it would be if it was ranked according to size. A good unit to use, therefore, would be the *cost* of the battery and its maintenance for doing a certain definite amount of work during a certain time, assuming, of course, that this amount of work is properly chosen. It may be claimed that it is unscientific to introduce the cost as the fundamental unit, but if such tests are made to inform the public which is the better cell for it to buy, we think there is no more rational and satisfactory unit of comparison. In justice to Prof. Jamieson, whose tests are the ones referred to, it should be stated that he merely selected two cells of about the same bulk and does not appear to claim that this was the best way of comparing cells in general.

How to Deal with Apparent Death from Electric Shock.

BY AUGUSTIN H. GOELET, M. D.

Much interest has recently been excited by the report from France of the resuscitation of a man apparently killed by electricity, and by the announcement of the French scientist d'Arsonval that a person so shocked should be treated as one drowned. The suggestion is a good one but may be somewhat misleading unless understood; that is, unless the person undertaking the resuscitation appreciates what is to be accomplished and just how it is to be done.

As this authority says, an electric shock may produce death in one of two ways, viz:

(1) By producing destructive tissue changes, when death is absolute; or (2), by producing sudden arrest of the respiratory and heart muscles through excitement of the nerve centres, when death is only apparent; in other words animation is merely suspended. The subject may be aroused from this syncope if efforts at resuscitation are not too long delayed.

FIRST POSITION.

SECOND POSITION.

The alternating current, which is usually regarded as the most deadly, strange to say, nearly always produces death in this second manner.

To say that a person has received a shock from a wire conveying a current of four or five thousand volts, does not necessarily signify that the body has been subjected to the full force of the current, even if the meter does register nearly one ampere during the time of the accident. In view of the fact that the human body offers a resistance of several thousand ohms, which resistance is greatly increased by imperfect contact, and by charring and burning the tissues at the points of application, it is not often that the internal structures or vital organs are submitted to a very considerable volume of current, though it apparently passes through the body. It must be borne in mind that when the clothing is moist with perspiration or wet with rain, it offers a circuit of less resistance than the human body, and in this event the body receives only a shunt current very much less in quantity than the main current. The bulk of current, in this instance, passes over the surface and does not enter the body. This may explain the survival of some who have apparently withstood very powerful currents.

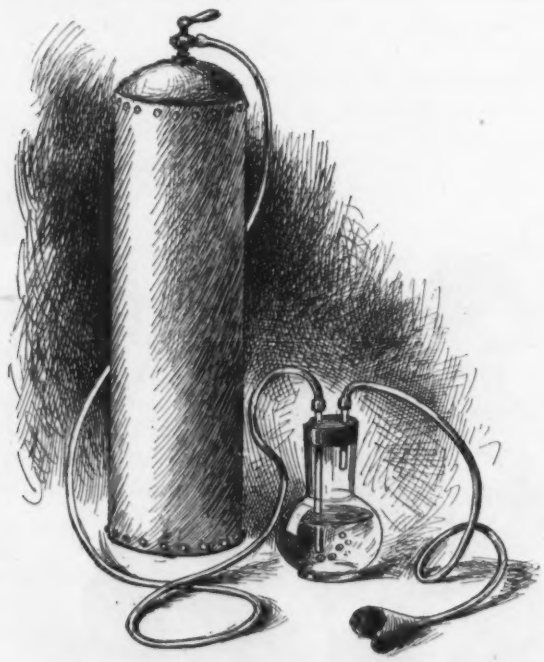
It must be presumed, therefore, that electricity seldom kills outright, though the condition of suspended animation, which it induces, would result in death if not counteracted.

All things considered, it is rational to attempt the resuscitation of those apparently killed by electricity, and if not too long delayed, the effort promises fair chances of success, provided proper means are instituted.

If the body has actually been submitted to a current of sufficient volume to produce destructive tissue changes, all efforts at resuscitation will, of course, be futile.

If, on the other hand, only respiration and the heart's action have been temporarily arrested, there is a condition of syncope simulating apparent death by drowning, or from anæsthetics, and the physician knows that patients in this condition are frequently revived. Laymen will appreciate the nature of this condition if it is explained as one of exaggerated faint and would not feel appalled upon encountering it if previously instructed how to cope with it. In an ordinary fainting spell the necessity to stimulate is universally appreciated. In syncope resulting from an electric shock stimulation is likewise indicated, but more vigorous measures are required. This is the only difference.

As said above, the direction to treat one shocked by electricity as one drowned may be misleading, as the conception of the layman of the necessities in this case would be to roll the body on a barrel. Let him understand that the condition is one of exaggerated faint, that the necessity is for prompt stimulation, and that the quickest and most powerful stimulent which can be employed is artificial respiration. *The man must be made to breathe*, if this is possible, and efforts to induce respiration must not be suspended until breathing is fully and normally restored or until it is absolutely certain that life is extinct. This cannot be assured in less than an hour's persistent, energetic, tireless effort.



Oxygen Cylinder and Appliances.

The accompanying illustrations will serve to make intelligible the following directions for artificial respiration:

The body must be placed upon the back. A roll made of a coat or anything else convenient (*rolled*, not folded) is placed under the shoulders, and must be sufficiently large to so prop the spine up as to drop the head backwards. The operator should kneel behind the subject's head, facing him, grasp the elbows and draw them well over the head, so as to bring them almost together above it, and hold them there for two or three seconds. Then he carries them down to the sides and front of the chest, firmly compressing it by throwing his weight upon them. After two or three seconds the arms are again carried above the head and the same manœuvre is repeated, at the rate of fifteen or sixteen times per minute. At the same time the tongue must be drawn out to free the throat. This manipulation stimulates respiration in the following manner, viz.: When the arms are extended over the head, the chest-walls are expanded, just as in inspiration, and if the throat is clear the air will rush into the lungs. When the arms are brought down to the sides of the chest, compressing it, the air is expelled, just as in expiration.

An Improvised Mouthpiece.

This is the most convenient and reliable manner of inducing artificial respiration. It is known as Sylvester's method. The operator must, however, appreciate the fact that this manipulation must be executed with *methodical deliberation* just as described and never hurriedly nor half-heartedly. To grasp the arms and move them rapidly up and down like a pump-handle is both absurd and absolutely useless.

In addition to this, if an assistant be at hand, the tongue, held by a cloth or handkerchief to prevent slipping, should be seized and drawn forcibly out during the act of inspiration or when the arms are extended above the head, and when the chest is compressed it may be allowed to recede. This rhythmical traction upon the tongue is in itself an excellent stimulant of respiration. It acts not only by freeing the throat of the tongue, which may fall back and obstruct breathing, but also by reflex irritation, through the fraenum or bridle under the tongue being drawn forcibly against the lower teeth.

Should these efforts fail to elicit any response or arouse any signs of life, recourse may be had to another method of stimulation by exciting the dormant nerve centres. This should, however, be reserved for the physician, who should always be summoned when it is possible to get one, or should be made use of only by one who realizes the injury that may be done if it is carelessly practiced. Still, when the necessity is great and other means have been exhausted, some risk is allowable.

I refer to forcible stretching of the sphincter muscle controling the rectum or lower bowel. It is well known to physicians that this muscle is the last portion of the body to lose its sensibility and that by irritating it by forcibly stretching, a gasp will often be elicited from one actually moribund.

The method of procedure is this:

Turning the patient on the side, the index finger or thumb is

inserted into the rectum and the muscle, which, if sensible, will be felt to resist, should be forcibly and suddenly drawn *backwards*, towards the spine. Care must be taken not to introduce the finger roughly, or to use sufficient force to lacerate or wound the parts.

Having obtained one gasp, artificial respiration should be continued and a repetition of the proceeding should be reserved until respiration again fails. In some instances, however, it may be necessary to repeat this with every effort at inducing inspiration, that is, every time the arms are extended over the head. The subject then being on the back, the knees are drawn upwards to facilitate access to the rectum.

If the accident occurs in a city or large town, oxygen, which may be obtained at every drug store may be used. This is a powerful stimulant to the heart if it can be made to enter the lungs.

This gas comes in cylinders furnished with a stop-cock and tubes and bottle, which latter is to be half filled with water through which the gas passes when turned on. [See figures.] If a cone or mouth-piece is not furnished with the apparatus, one can be hastily improvised from a piece of stiff paper and attached by a string to the ordinary mouth piece. To use the oxygen, place the cone over the patient's face and turn on the stop-cock until the gas is seen to bubble freely through the water in the bottle. Efforts at artificial respiration should be kept up while the gas is being administered to favor its entrance into the lungs.

The use of electricity to re-awaken the heart and lungs to action offers another auxiliary to the resuscitation process, but implies the skilled employment of special electrical apparatus purely within the possession of the physician, who naturally does not require instruction.

When I was requested by the editors of THE ELECTRICAL WORLD to contribute this article I gladly accepted because:

(1) I am convinced that many who have died in consequence of electrical shocks might have been saved if those at hand had been properly instructed in the methods of reviving suspended animation, and,

(2) I hope all electrical companies will be impressed with the importance of having their linemen and other employees engaged in the vicinity of dangerous currents, so instructed and trained that without delay methods of resuscitation can at once be instituted.

Thus the giant electricity will more surely become man's servant, a faithful and ever obedient one, instead of as now, occasionally, through man's carelessness, his slayer.

Dynamo-Electric Machinery—VI.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

MAGNETIC FLUX.

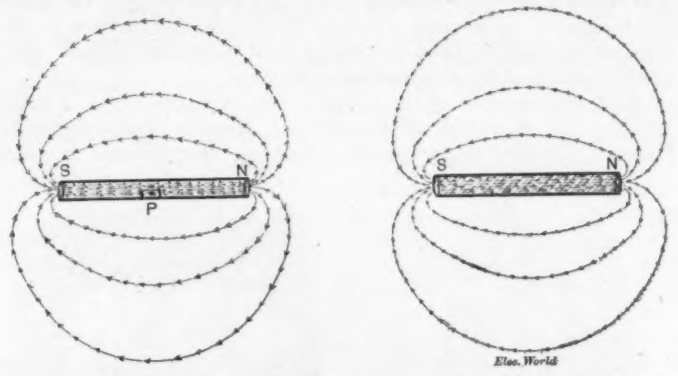
22. A magnet is invariably accompanied by an activity in the space or region surrounding it. Every magnet produces a magnetic field or flux, which not only passes through the substance of the magnet itself, but also pervades the space surrounding it. In other words, the property ordinarily called magnetism, is, in reality, a peculiar activity in the surrounding ether, known technically as *magnetic flux*.

By a simple convention, magnetic flux is regarded as passing out of the north-seeking pole of a magnet, traversing the space surrounding the magnet, and finally re-entering the magnet at its south-seeking pole. Magnetic flux or magnetism is circuital; that is, the flux is active along closed, re-entrant curves.

23. Although we are ignorant of the true nature of magnetic flux, yet, perhaps, the most satisfactory conception we can form concerning it, is that of the ether in translatory motion. In other words, that in a magnet, ether is actually streaming out from the north-seeking pole and re-entering at the south-seeking pole.

Since the ether is assumed to possess the properties of a perfect fluid, i. e., to be incompressible, readily movable, and almost infinitesimally divisible, it is evident that if a hollow tube, or bundle of hollow tubes, of the same aggregate dimensions as a magnet, be conceived to be provided internally with a force pump in each tube, and that such tube be placed in free ether, then on the action of the force pumps a streaming would occur, whereby the ether would escape from one end of the tubes, traverse the surrounding space, and re-enter at the other end of the tubes. Moreover, if the stream lines, through which the ether particles would move under such ideal circumstances were mapped out, they would be found to coincide with the observed paths which the magnetic stream lines take in the case of a magnet.

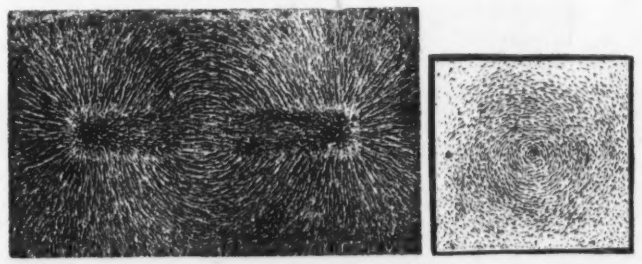
Similar stream lines could be actually observed in the case of a hollow tube provided internally with a pump, and filled with and surrounded by water; only, in this case, on account of the friction of the liquid particles, both in the tube, and between themselves, work would require to be done, or energy expended, in maintaining the motion, and unless such energy were supplied, the motion would soon cease. In the case of the ether, however, there being no friction, although energy would probably be required to set up the motion, yet, when once set up, no energy would be required to sustain it, and the motion should continue indefinitely. This is similar to what we find in the case of an actual steel bar



FIGS. 20 AND 21.—DIAGRAMS REPRESENTING A TUBE, IMMERSED IN WATER, WITH A FORCE-PUMP AT ITS CENTRE.—HYDROSTATIC STREAM LINES, AND A CYLINDRICAL BAR OF IRON, MAGNETIZED, I. E., WITH A M. M. F. ACTIVE WITHIN IT.—MAGNETIC FLUX STREAM LINES.

magnet. The above theory is merely tentative, and the real nature of magnetism may be quite different; but assuming its correctness, there is no knowledge as to the pole of the magnet from which the ether issues. It is assumed, however, as above stated, to issue from the north-seeking pole.

24. Fig. 20 represents, diagramatically, a tube provided at its center with a rotary pump P, and immersed in water. If the pump were driven so as to force the water through the tube in the direction of the arrows, i. e., causing the water to enter at S and leave at N, then stream lines would be produced in the surrounding water, taking curved paths, some of which are roughly indicated by arrows. Fig. 21 represents the application of this hypothesis to the case of a bar magnet of the same dimensions as the tube. Here the *magneto-motive force* of the magnet, corresponds to the water motive force pump in Fig. 20, and is hypothetically assumed to cause an ether stream to pass through the magnet in the direction indicated by the arrows; namely, to enter at the south pole and issue from the



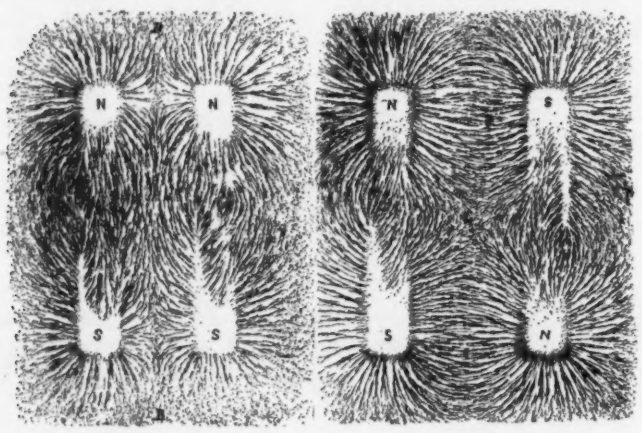
FIGS. 22 AND 26.—DISTRIBUTION OF FLUX ABOUT A STRAIGHT BAR MAGNET IN A HORIZONTAL PLANE, AND ROUND A VERTICAL WIRE CARRYING A CURRENT, AS INDICATED BY IRON FILINGS.

magnet at the north pole, and these ether streams would constitute hypothetically the magnetic flux and would pass through the surrounding space in paths roughly indicated by the arrows. The actual flux paths that would exist in the case of a uniformly magnetized short bar magnet are more nearly shown in Fig. 22. Here it will be noticed that the flux by no means issues from one end only of the magnet, re-entering at the other end. On the contrary, the flux, as indicated by chains of iron filings, issues from the sides as well as from the ends of the bar. The reason for this is evidently to be found in the fact, that each of the particles or molecules of the iron is, in all probability, a separate and independent magnet, and, therefore, must issue its own ether stream independently of all

the rest. The effect is, therefore, the same as if a very great number of minute voltaic cells were connected into a single battery in series, and the whole immersed in a conducting liquid where side leakage can exist.

25. The magnetic field, that is the space permeated by magnetic flux, may be mapped out in the case of any plane section, by the use of iron filings. For example, Fig. 22, before alluded to, as representing the flux of a straight bar magnet, had its flux-paths mapped out as follows: A glass plate, covered with a thin layer of wax, was rested horizontally on a bar magnet, with its wax surface uppermost. It was then dusted over with iron filings and gently tapped, when the iron filings arranged themselves in chain-forms, which are approximately those of the stream-lines of magnetic flux. A satisfactory distribution having been obtained in this manner, the glass plate is gently heated in order to fix the filings. On cooling, the filings are sufficiently adherent to the plate to permit it to be used as the positive from which a good negative picture can be readily obtained by photographic printing.

26. A modification of the above process was employed in the case of Figs. 22 A and B, shown below. Here a photographic positive was obtained by forming the field, in the manner previously



Figs. 22 A and B.—Magnetic Phantoms.

explained, on a sensitivized glass plate in a dark room, instead of on a waxed plate; and, after a satisfactory grouping of filings had been obtained under the influence of the field, exposing the plate momentarily to the action of light, as, for example, to a momentary flash of light. The filings are then removed, the plate developed, and the negative so obtained employed for printing.

27. Magnetic flux may vary in three ways, namely: (1) in direction, (2) in intensity, (3) in distribution. The direction of magnetic flux at any point can be readiy determined by the direction assumed, at that point, by the magnetic axis of a very small, delicately suspended compass needle. The compass needle always coming to rest threaded by the flux, which entering at the south pole, and leaving at its north pole, causes the needle to point in the direction of the flux. Assuming that a compass needle may be represented by a little tube containing an ether force pump, the tube would evidently come to rest when the flux it produced passed through it in the same direction as the flux into which it was brought. That is to say, if the needle be brought into the neighborhood of a north pole, it would come to rest with its south pole pointing towards the north pole of the controlling magnet, since in

Figs. 23 and 24.—Analogues Showing Attraction of Opposite Poles and Repulsion of Similar Poles.

this way only could a maximum free ether motion be obtained. If, however, the compass needle be held in the opposite direction i. e., with its north-seeking pole towards the north-seeking pole of the magnet, the two opposed stream lines would, by their reaction, produce a repellent force. These effects are generally expressed as follows: like magnetic poles repel, unlike magnetic poles attract. This statement is not correct, since whatever theory of magnetism be adopted, it is the fluxes and not the poles which exercise repulsion.

28. Fig. 23 represents the action of the flux from a magnet upon a small compass needle, as illustrated by the hydrostatic analogy. The water is represented as streaming through the tube O N, and issuing at the end N in curved stream lines. Suppose the small magnet, or compass needle, S N, also has a stream of water flowing through it, entering at S and leaving at N. Then if the compass needle be free to move about its center of figure, it would come to rest when the stream from the large tube O N flowed through the smaller tube from S to N, that is, in the direction of its own stream.

If, however, the small tube S N is not free to move, but is fixed with its end N towards the end N of the larger tube, as shown, then the opposite streams would conflict, and produce, by their reaction, the effect of repulsion between the tubes.

29. Magnetic flux possesses not only definite direction, but also magnitude at every point; that is to say, the flux is stronger nearer the magnet than remote from it. For example, considering a mag-

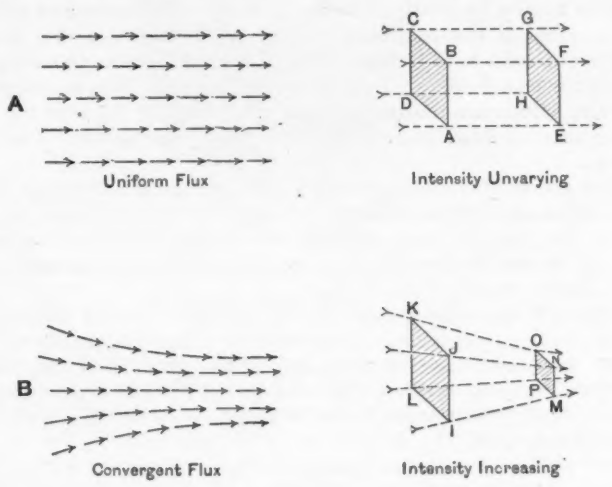


Fig. 25.—Varieties of Flux.

net as being represented by a tube with an ether force pump, the velocity of the ether flux will be a maximum inside the tube and will diminish outside the tube as we recede from it. The intensity of magnetic flux is generally called its *magnetic intensity* or *flux density*.

Faraday, who first illustrated the properties of a magnetic field, proposed the term *lines of magnetic force* instead of magnetic flux, or stream-lines, here employed, and the term lines of magnetic force has been very generally employed. The term, however, is objectionable, especially when an attempt is made to conceive of magnetism as possessing flux density, or as varying in intensity at any point; for, in accordance with Faraday's conception, the idea of an increased flux would mean a greater number of lines of magnetic force traversing a given space. While this might be assumed as possible, still the conception that magnetism acts along lines, and not through spaces, is very misleading, and an endeavor has been made to meet this objection by the introduction of the term *tubes of force*. A far simpler conception is that of velocity of ether, as suggested by the force pump analogue. Here the increased flux density at any point would simply mean an increase of ether velocity at such point.

30. Intensity of magnetic flux is measured in units called *gausses*, after a celebrated German magnetician named Gauss. A gauss is an intensity of the same order as that produced by the earth magnetism

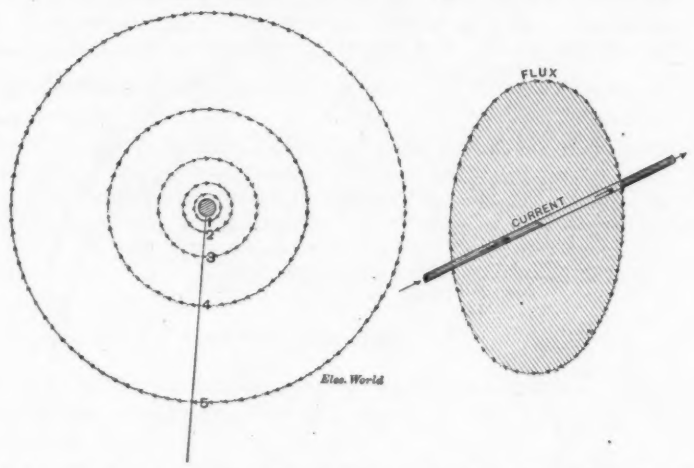
on its surface. For example, the intensity of the earth's flux at Washington is about 0.6 gauss at a dip or inclination of 70°.

Magnetic flux may be uniform or irregular. Fig. 25, A, shows a uniform flux distribution, as represented by straight lines at uniform distances apart. That is to say, uniform intensity at any point is characterized by rectangularity of direction in path at that point. Irregular intensity is characterized by bending, and the degree of departure from uniformity is measured by the amount of the bending. Irregular flux density may be either converging, as at B, or diverging, as at C. Convergent flux increases in intensity along its path, and divergent flux diminishes.

31. When the flux paths are parallel to one another, the intensity must remain uniform. Thus, in Fig. 25 at A, let the area A B C D be 1 square centimetres then the amount of flux which passes through it in this position, or, in our hydrostatic analogue, the quantity of water which would flow through it in a given line will be the same if the area be shifted along the stream line parallel to itself in the position E F G H.

Where the flux converges, as at B in Fig. 25, then the amount of flux passing through the normal square centimetre, I J K L, will further on pass through a smaller intercepting area, say one-fourth of a square centimetre, M N O P, and consequently the intensity at this area would be four times greater, and in the hydraulic analogy the same quantity of water passing per second, flowing through a cross sectional area four times more constricted, will flow there with four times the velocity.

When the flux diverges, as at C, the opposite effect is produced. Thus the flux shown in the figure as passing through the area Q R



FIGS. 27 AND 28.—GEOMETRICAL DISTRIBUTION OF FLUX PATHS ROUND A WIRE CARRYING A CURRENT AND DIAGRAM OF RELATIVE DIRECTIONS OF MAGNETIC FLUX AND ELECTRIC CURRENT.

S T, say one-fourth of a square centimetre, would at U V W X pass through one square centimetre, at four times less density, or, in the case of the hydraulic analogyt at one-fourth of the velocity.

32. The existence of a magnetic flux always necessitates the expenditure of energy to produce it. In the case of the ether pump, assuming that energy was required to establish the flow through the tube, this energy being imparted to the ether, becomes resident in the moving ether, so that the ether, plus energy of motion, necessarily possesses different properties from ether at rest. In the same way in the case of a magnet, the energy required to set up the magnetic flux, i. e., to magnetize it, is undoubtedly associated with such flux. Wherever the magnetic intensity is greatest, there the corresponding ether velocity, according to our hypothesis, is greatest, and in that portion of space the energy of motion is greatest.

33. It is well known dynamically, as a property of all known motion, that the energy of such motion in a given mass varies as the square of the velocity, so that, by analogy, if magnetic flux density corresponds to ether velocity, we should expect that the energy associated with magnetic flux should increase with the square of its intensity. This is experimentally found to be the case. Thus if $\mathfrak{B}$ represents the intensity of magnetic flux, expressed in gausses, then the energy in every cubic centimetre of space, except in iron or other magnetic material, i. e., in the ether permeated by such intensity, is $\frac{\mathfrak{B}^2}{8\pi}$ ergs. Thus, if a cubic inch of air (a volume of 16.387 cubic centimetres), be magnetized to the intensity of 3,000 gausses, the energy it contains, owing to its magnetism, will be

$$\frac{16.387 \times 3000 \times 3000}{8 \times 3.1416} = .5868 \times 10^7 = 0.5868 \text{ Joule.}$$

34. Just as in the electric circuit, the presence of an electric current necessitates the existence of an E. M. F. producing it, so in a magnetic circuit, the presence of a magnetic flux necessitates the existence of a magneto-motive force (M. M. F.) producing it. We know of but two methods by which a M. M. F. can be produced, viz.:

(1) By the passage of an electric current, the neighborhood of which is invested with magnetic properties, i. e., surrounded by magnetic flux;

(2) As a property inherent in the ultimate particles of certain kinds of matter, possibly the molecules, of the so-called magnetic metals.

The passage of an electric current through a long, rectilinear conductor, is attended by the production of a magnetic field in the space surrounding the conductor. The distribution of flux in this field, is a system of cylinders concentric to the conductor, and is directed clock-wise around the conductor, if the current be supposed to flow through the clock from the face to the back. This distribution is shown in Figs. 26, 27 and 28. Fig. 26 (p. 231) represents the distribution as obtained by iron filings. The density of the flux is roughly indicated by the density of the corresponding circles.

35. Fig. 27 shows the geometrical distribution of the flux paths around a wire carrying a current, which is supposed to flow from the observer through the paper. Here a few of the flux paths are indicated by the circles, 1, 2, 3, 4 and 5, while the direction is shown by the arrows. The distribution of the flux is such that it varies in intensity inversely as the distance from the axis of the wire, and the total flux between any adjacent pair of circles is the same; for example, the same between 1 and 2, as between 4 and 5, or in the hydraulic analogy, the total flow of water per second between any pair of adjacent circles is the same, as across the boundaries 2, 3, or 4, 5, the velocity diminishing as the distance from the axis of the wire.

Fig. 28 represents the direction of the flux round the active conductor, the current flowing from the observer through the shaded disk.

(To be Continued.)

Electric Lighting in Great Britain—IV.

BY E. RAY STEVENS.

The number of electric light plants in the United Kingdom that are owned and operated by companies is slightly in excess of the number operated by municipalities. But the present tendency is toward public operation, and the balance will soon be in favor of public plants if some counteracting course does not intervene. We can form a somewhat better judgment of the success of private than of public operation because of the fact that more of the private than of the public plants have been operated for a period of three or four years.

The plant at Southampton has been in operation four years and in the first three years of that time performed the unusual feat of reducing the cost of light from 64.48 cents per unit to 8.64 cents, a little more than one-eighth the cost of production during the first year of operation; last year expenses had been so reduced as to leave a gross profit of $1,200, from which the company was for the first time able to pay interest. Last year the consumption was nearly 55,000 units, or almost eleven times what it was in 1891.

The company at Liverpool, which has operated its plant for but four years, made a gross profit of over $55,000 during the first year; last year it had reached $77,000. In the three years the plant had been extended sufficiently to increase the capital from $810,000 to $1,070,000. Last year $34,000, or over three per cent. of the total capitalization, was set aside for the sinking fund. The cost of coal per unit consumed was 1.92 cents in 1891 and 1.86 cents in 1893, an advance of .4 cent over the cost in 1892, caused by the scarcity of coal last year. The cost of all, carbons, etc., was .42 cents per unit in 1891 and .32 cents in 1893; wages cost .96 cents in 1891 and .76 cents in 1893. The cost of repairs and maintenance was 1.2 cents in 1891 and 1.28 cents last year. The total cost per unit, including taxes and cost of management, was 6.04 cents in 1891 and 5.72 cents in 1893. During the same period the average charge per unit had been reduced from 14.9 cents to 13.58 cents.

Among the more prosperous undertakings is that of the Westminster company, which last year supplied nearly three times the amount consumed in 1891. The gross profits have, during the same time, increased nearly four-fold, and were last year $92,000 on a

capitalization of $1,905,000. The cost of production and distribution has been lowered from 6.66 cents per unit in 1891 to 4.57 cents last year, while the total cost per unit was lowered from 10.64 cents to 6.88 cents during the same period, and the average price charged lowered from 14.44 cents to 11.86 cents per unit.

The company at Notting Hill has been operating its plant for four years, during the first two of which the gross revenues did not meet the total cost of operation. During the first year especially, the wages, salaries, maintenance and office expenses were very high. The consumption of the first year was but 30,000 units, but last year the number of units supplied to customers was over 100,000, which yielded a gross profit of 7,000. Last year for the first time the company was able to pay interest, but as yet nothing has during the three years of operation been written off for depreciation or set aside for sinking fund. The total cost per unit has been reduced from 24.66 cents in 1891 to 10.58 cents in 1893. During the same period there has been a slight reduction in the average charge, which was 16 cents per unit in 1891 and 15.64 cents in 1893.

These are representative examples and give a fair idea of the ups and downs of electric lighting companies in England. A comparison of the results attained by public and private operation, so far as these can be obtained at the present time, will be interesting and of value as well. In order to make the comparison of greater value, all plants whose operation was begun during the year 1893 will be omitted, as conclusions drawn from the results of the first year of operating a plant can have but a very slight value.

As far as figures could be obtained there was not found a single public plant that ran at a loss during the second or any subsequent year of its operation. While the company at Southampton failed to meet ordinary expenses during the first two years, the latest returns show that the companies at Preston as well as the London Electric failed to make expenses during both the years reported. All the city plants that have been operated more than one year have since the very first been able to pay interest, taxes, depreciation and sinking fund charges, while there are four companies that have not paid interest during the first one or two years of operation, but all are now meeting this charge. There are also ten companies that have failed during one or more years to set side a sum for depreciation and sinking fund. Three of these companies which were established in 1892, failed to meet that charge, either in that year or during last year, and one company, established in 1891, has not met the charge in any of the three years.

The tendency has been to largely reduce the cost of production per unit consumed. It was lower in all plants last year than during the first year of their operation, with the exception of those operated by two different private companies. As a rule the average charge for service was lower last year than when operation was begun. To this there are five exceptions, four private companies and one public plant.

Perhaps the best way of summing up the figures that are at hand will be to give the averages of all that are available. In finding the cost of light, the average of which is given in the first line, interest, dividends, depreciation and sinking fund contributions have been excluded, because of the fact that they are fixed in an arbitrary way and vary greatly in different cities, but taxes, wages and all other expenses of operation and management are included. In the second line the average charge in each city is used. The gross surplus is in each case the difference between one hundred per cent. and the percentage of the total cost per unit to the total revenue per unit. All the figures taken apply to the year 1893 alone.

Items Compared.	Private.	Public.	Difference.
Average actual cost per unit.....	8.35c.	6.06c.	2.29c.
Average charge per unit.....	12.10c.	11.54c.	.56c.
Gross surplus.....	30.23 p. c.	50.28 p. c.	20.06 p. c.

It should be added that these averages deal with commercial lighting alone. Few cities have as yet replaced gas by electric light as a means of illuminating their streets and public places. This table shows that, considered both from the standpoint of the consumer and of the manufacturer, the municipalities of Great Britain are fully as successful in operating their plants as are private companies. Their gross surplus is two-fifths greater than that of the companies, while the average cost of manufacture is about three-fourths. There is also the saving of a half cent per unit to the consumers where the city owns and operates the plant.

Action of a Transformer with a Condenser in Parallel with the Secondary—III.

BY FREDERICK BEDELL AND ALBERT C. CREHORE.

EFFECTS OF A VARIATION OF THE CONDENSER CAPACITY WHEN THE PRIMARY CURRENT IS CONSTANT.

We are now prepared to construct the diagram to represent a transformer supplied with a constant primary current, the circuit being that of Fig. 1, when the condenser capacity is varied.

Referring to Fig. 9, let OA represent the constant primary current; OB, equal to $M\omega I_1$, and 90° behind the primary current, is the constant impressed electromotive force in the transformer secondary. Take OB′, Fig. 5, as the selected value of the secondary E. M. F., which is to be kept constant. This is made equal to OB Fig. 9. When the condenser capacity is zero, we have the parallelogram $OC_1BC'_1$, Fig. 9, equal to $OCB'C'_1$, Fig. 5; and so OC_1; OD_1, and OQ_1, are lines in Fig. 9 that correspond with OC, OD, and OQ_1 in Fig. 5, and these are values of corresponding quantities when the condenser capacity is zero, or when the condenser is absent. Lay off OS, Fig. 9, so that the angle BOS equals arc tan $\frac{L_2\omega}{r}$ equal to the angle COC'_1, Fig. 5, which OC makes with the perpendicular upon the line BB′. Then will OS be the *direction* of the diameter of the circle upon which OC varies, according to the previous theorem, and, since one point C_1 on the circle, is determined, this determines the circle C_1SCO which may now be drawn. OC is any position of the variable. The resultant of OC, the con-

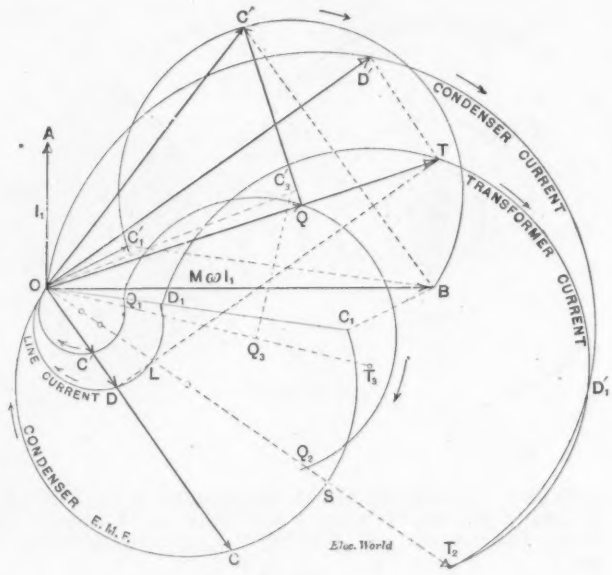


Fig. 9.

denser electromotive force, and OC′ the E. M. F. for the impedance of the transformer gives the total impressed E. M. F., OB. Hence the locus of C′ is a circle $C'_1C'B$ similar to the locus of C. The E. M. F. for the transformer impedance is now resolved into its two components OQ and QC′, at right angles to one another, making the angle QOC′ equal to arc tan $\frac{L_2\omega}{r}$ equal to BOS. OQ is then that component of the total E. M. F. for the transformer resistance alone. QC′ is that for the transformer self induction. OQ has the drection of the transformer current OT, and is equal to OT divided by the transformer resistance r. Hence we have one position of the transformer current OT, which corresponds with the position OC of condenser E. M. F. Since the current OD through the line is proportional to the E. M, F. at the condenser terminals, OC, and equal to it divided by the resistance R, the locus of OD is a circle similar to OCS upon OL as diameter. And, since OT the transformer current is the geometrical sum of OD the line current and OD′ the condenser current, we have OD′ equal and parallel with DT.

It is evident that the locus of OQ is the circle Q_1QQ_2 having a centre Q_3 situated so as to make C'_3OQ_3 a triangle similar to C′OQ; as C′ moves around its circle the point Q always lies behind it by an angle arc tan $\frac{L_2\omega}{r}$ and when C′ arrives at B, Q arrives at Q_2 upon the line OS. The centre Q_3 of this circle is similarly situated behind C'_3 the centre of the other circle, as the points in the cir-

cumference are so situated. Likewise the locus of OT is a circle D_1TT_2 similar to Q_1QQ_2 having its centre at T_3 so that OT_3 equals QQ_2 divided by r. Having the loci of T and of D, that of D′ is found since OT is always the resultant of OD and OD′. The locus of OD′ the condenser current is the circle $OD'D'_1T_2$ upon OD'_1 as diameter, which is OC_1 prolonged. That the diameter has this direction appears from the following: OD′ is always at right angles to OC, but when OC coincides with OC_1, the condenser current is zero and OD′ starts out at the origin perpendicularly to OC_1. Hence the diameter has the direction of OC_1. The circle passes through T_2 because the transformer and condenser current coincide when the capacity is infinite, inasmuch as either current is very large compared with the line current OD at this point. When the capacity is infinite, it is equivalent to short circuiting the transformer by a stout wire so that no current will pass through the line. In this case the diagram becomes simple and the triangle of electromotive forces is as usual OBQ_2 so that BOQ_2 equals arc tan $\frac{L_2\omega}{r}$, and OT_2 equals OQ_2 dvided by r.

Having obtained the current OT through the secondary of the transformer, the back E. M. F. and primary E. M. F. are readily obtained by methods discussed in previous papers. The construction for this is omitted from the diagram to avoid complexity. The reaction of the secondary upon the primary will be taken up later.

DIAGRAM FOR ACTUAL TRANSFORMER WHEN THE CONDENSER TERMINALS HAVE A CONSTANT POTENTIAL DIFFERENCE, AND THE CAPACITY IS VARIED.

In practice there is a modification which amounts to a simplification that enters into the construction of this diagram. The transformer inductance is usually very large as compared with the internal resistance so that the angle arc tan $\frac{L_2\omega}{r}$ is almost ninety degrees.

Take the particular example of the constant current transformer considered in the previous papers, viz.: that for which the constant current polar diagram is given in Article IV, Fig. 9.* The data for the transformer is as follows: $L_1 = .032$ henrys, $L_2 = .016$ henrys $R_1 = .227$, $r_2 = .16$ ohms. $\omega = 1000$. A calculation gives,

$$\frac{L_2\omega}{r_2} = \frac{.016\times1000}{.16} = 100.$$

Hence, arc tan $\frac{L_2\omega}{r_2} = 90°$ approximately.

To draw the actual diagram, Fig. 10, corresponding to the typical diagram, Fig. 5, take OC arbitrarily equal to 150 volts. Let the

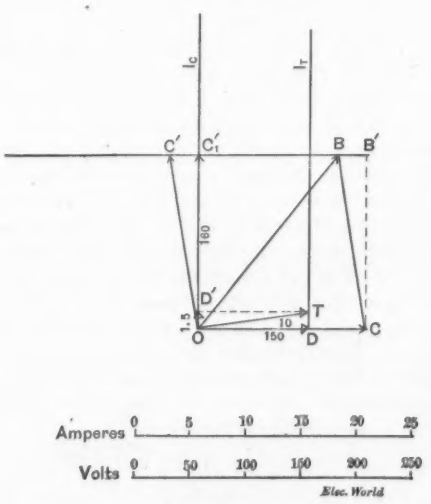


Fig 10.

line resistance R be 15 ohms, a rather high value. Then OD equals $150 \div 15 = 10$ amperes. The condenser current OD′, varies upon the line I_c and the transformer current upon I_t. When the condenser capacity is ten microfarads, the condenser current, $C\omega$ times OC, is equal to $1000 \times 150 \times 10^5 = 1.5$ amperes, and is represented by OD′. This gives the transformer resultant current OT a trifle more than ten amperes.

When the condenser capacity is zero, T coincides with D, and the impressed E. M. F. to drive this current through the transformer is $L_2\omega$ times the current OD, and is 90° in advance of it. $L_2\omega \times OD = .016 \times 1000 \times 10 = 160$ volts. Hence OC_1', ninety degrees in advance of OD and equal to 160 volts, is the E. M. F. for the transfromer impedance. Since the E. M. F. OC′ is always 90° in advance of OT and equal to $L_2\omega$ times OT, the locus of C′ is the line $C_1'C'$ at right angles to OC_1'. The transformer impressed E. M. F., OB has for its locus BB′ in the same straight line with $C'C_1'$. This evidently corresponds completely with the diagram Fig. 5, when the angle COC_1' becomes 90°. The lines BB′ and $C_1'C'$ beome one and the same straight line parallel with OC.

THE ACTUAL TRANSFORMER DIAGRAM FOR CONSTANT PRIMARY CURRENT, WHEN THE CAPACITY IS VARIED.

The typical diagram, Fig. 9, representing a general case is likewise modified in the actual case supposed, since the angle C′OT

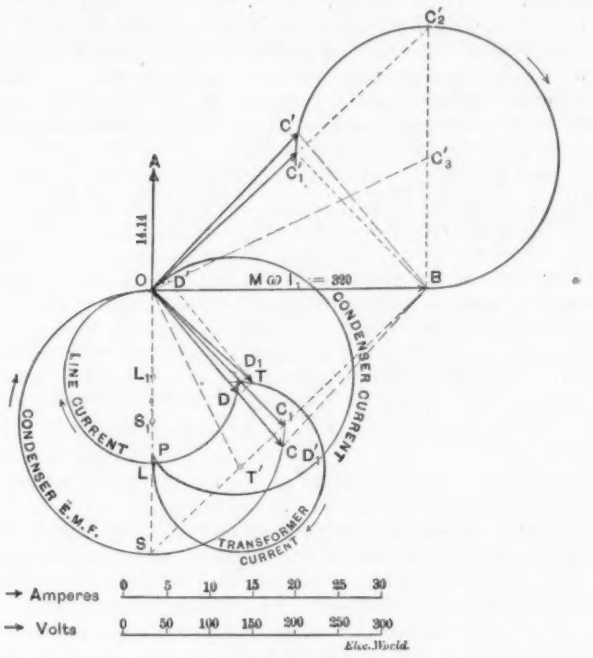


Fig 11.

becomes approximately a right angle. Let OA, Fig. 11, represent the primary current of 14.17 amperes supplied to the transformer, the data of which appears above. Then the impressed E. M. F., OB upon the secondary is 320 volts. When the condenser capacity is zero we have a rectangle OC_1BC' upon OB as diagonal similar to that in Fig. 10, viz: $OCB'C_1'$. The angle BOC_1 is arc tan $\frac{L_2\omega}{r+R}$ and in the case supposed is

$$\text{arc tan } \frac{.016 \times 1000}{.16 + 15} = 46°.5 \text{ approx.}$$

The circle OSC_1 here has its diameter OS at right angles with OB; and since C_1 is a point on the circle, the length of the diameter OS is found by drawing a line from C_1 perpendicular to OC, until it intersects the perpendicular to OB in S. This line C_1S is then the line BC, prolonged to S. The locus of OC′, the E. M.F. for the transformer impedence, is now determined by a circle upon BC_2' as diameter parallel with OS and symmetrically situated with respect to OB. The locus of OD the current through the line is a circle OLD upon a diameter OL having the direction of OS and equal to OS′ divided by R. The condenser current, being always at right angle in advance of the E. M. F., OC has for a locus a circle $OD'D_1'P$ whose diameter OD_1' has the direction of OC, as explained in Fig. 9. The resultant or transformer current is determined by the two component currents already drawn; but it is a circle whose center T′ is on a line at right angles in this case behind the center C_2' as explained in Fig. 9.

(To be Continued.)

Care in the Use of Terms.

An esteemed contemporary, in an editorial, calls attention to the confusion which is caused by the incorrect use of terms, but in the same editorial it makes use of the term "bad magnetic air," evidently meaning air which has poor magnetic qualities; as it reads, it would mean bad (impure) air which is magnetic. Further-

* See The Electrical World May 27, 1893, page 391.

more, while air may, in a theoretical sense, be considered magnetic as distinguished from dia-magnetic, yet in practice it must surely be considered as non-magnetic, and it therefore does not seem advisable to call it magnetic, any more than to call copper an insulator of poor quality.

The American Electrical Works' Clambake.

The sixteenth annual clambake of the American Electrical Works was held at the beautiful Haute Rive last Saturday, August 25, and was attended by nearly 200 members of the electrical fraternity from all parts of the country. The weather was typical "clambake" weather. Most of the visitors went from Providence to the rendezvous per electric cars, and as fast as the various contingents arrived the fun and frolic began in right good earnest. President Eugene F. Phillips, Mr. W. H. Sawyer, Messrs. Hathaway, Ackerman, Carro.. and Donohue, all colleagues of Mr. Phillips, were on hand to welcome the guests. All regretted the enforced absence of Mr. Remington, who is just recovering from a serious attack of typhoid fever.

As soon as lunch had been partaken of, a baseball game was arranged between Boston and Providence teams, which resulted, after some fine playing, in Boston winning 26 to 6.

The usual round of amusements and pastimes was provided and enjoyed. During the kicking of the football, Mr. Donohoe had the misfortune to fall and strain one of the ligaments in his right leg rather severely. The artist was on hand, as usual, and secured good line shots at the party. The "bake" proper was as appetizing as ever, the seat at the head of the table being occupied by Mr. Eugene F. Phillips. Mr. C. W. Price, of New York, acted as toast-master, and the good things having been dispatched with alacrity, several brief but enjoyable addresses were delivered. The first speaker was Mr. J. C. Wyman, of Valley Falls, who was listened to with closest attention as he recounted how little he knew of the wonderful science, the representatives of which were present, and which was accomplishing so much for the world at large and would accomplish so much more in the future.

Mr. John I. Sabin, the well-known and popular telephone manager, and a life-long friend of Mr. Phillips, was present from San Francisco; he was the first who suggested the holding of these annual clambakes, and his remarks were cordially received.

Mr. Hibbard, manager of the Chicago Telephone Company, greatly entertained the company by singing a pleasant little ditty about a Sabbath-school pupil who always did as he was told.

Mr. Brown, of the Newburyport and Amesbury Electric Railway, briefly responded to a call for a speech.

After this the sports were resumed until evening, when a start was made for Providence, every one of the clam-eaters voting the occasion one of the pleasantest days ever spent together.

Storage Battery Litigation.

Judge Green, of the United States Circuit Court of the District of New Jersey, in his recent decision denying the motion of the Brush Electric Company for a preliminary injunction against the Electric Storage Battery Company, gives two grounds for his action. One is based upon the lack of necessary proof to show that the chloride accumulator infringes the Brush patent, and the other on the affirmation of inexcusable delay in bringing suit.

The complaint states that the validity of the Brush patent in question is beyond dispute, having been sustained by all the courts before which it has been the subject of litigation. The only question, therefore, to be considered upon the motion made, under the circumstances, is that of infringement, and the proof of alleged infringement must be clear and decisive. In the present case the court declares that the proof fails to attain this standard.

The opinion refers to the depositions of Professors Brackett, Cross, E. Thomson and Mr. Van Size for the complainants, as expert evidence entitled to great weight, and which assert quite positively that not only the storage battery manufactured by the defendants, but the process as well infringe, some if not all of the claims of the patent under consideration. These opinions, however, according to the court, rely for their justification, first, on the Brush patent and the various claims being given an exceedingly broad construction, and second, on such broad construction being based upon a yet broader one of the legal conclusions of judges who have in past litigations defined and characterized the inventions of Faure and Brush. On the other hand, Professors Morton, Chandler, Houston and Barker, who are declared equally as learned and of equal standing and repute in the scientific world, have presented antagonistic opinions, in which they most distinctly and positively declare that neither the process pursued by the defendants nor the completely manufactured battery infringe in the slightest degree on the cells of the plaintiff.

When, the court declares, the statements so made and the opinions so expressed come to be tested by severe and thorough cross examination, those which show themselves securely founded upon reason and fact will be immediately accepted and concurred in; but until then, the existence of a doubt through this difference of opinion is well founded and reasonable aid cannot be overlooked. This doubt is fatal to a motion for a preliminary injunction, as the immediate and threatened infringement of the right must appear as clear as the noonday sun.

In regard to the question of great diligence in the assertion and vindication of the complainants' rights, without which they will be shorn of any right to appeal for assistance, the court states that the case submitted shows that the dilatory conduct of the complainants in protecting their rights amounted to open encouragement, or, at least, silent acquiescence in their invasion, and such conduct debars absolutely the relief asked for at this time by the complainants.

In the opinion the history of the defendant corporation is given. It was organized under the laws of New Jersey in 1888 to manufacture and sell the chloride accumulator, and from the time of its incorporation it has openly and to the knowledge of the complainants carried on its business without interruption to the present. Reference is made to a pamphlet issued early in 1893 by the defendants, and widely circulated, containing an opinion of Professor Chandler, which goes at length into the details of the chloride battery, comparing it with the battery of the complainants and strongly asserting there can be no infringement. A letter written in July of the same year by the president of the Chloride Accumulator Company to the complainant company is quoted, in which infringement is denied and a demand made that the charge of infringement should either be sustained in court or suit for damages would be instituted. In the meantime the defendants, justifiably assuming that no attack was to be made upon them, increased their capital stock $250,000 and proceeded to erect an addition to their existing plant at a very large cost, and it was not until 1894, a number of months afterwards, that this present bill of complaint was filed.

The complainants alleged that their delay in bringing action was due to the time spent in making a diligent search for some purchaser of defendants' battery within the district of the United States Circuit Court for Southern New York, as in that district much of the previous litigation concerning the Brush and Faure batteries had taken place; further, that all the operations of the defendant were considered to be tentative and therefore not of a kind to justify a suit costing many thousands of dollars. The court decides that such excuses do not justify the delay of which the defendants have been clearly guilty. The result of their inaction is found in the increase of capital stock of the defendant and the expenditure of a large amount of money in the erection of a new plant. Upon the argument it was admitted that the defendant was financially responsible and amply able to respond to any award of damages that might be made against them. Under all the circumstances and for the reasons given the court therefore denied the motion for a preliminary injunction.

Cost of Producing Electrical Energy.

To the Editor of The Electrical World:

Sir:—In the issue of Aug. 4 of your esteemed journal I noticed, in an article by Mr. B. J. Arnold, a statistical table concerning German central stations, with whose compilation Mr. Laffargue of Paris is credited. This table, of which Mr. Arnold says "that it is the most complete information regarding foreign central stations," was, however, not worked out by the above named gentleman, but by me, being based on material laboriously collected. Mr. Laffargue has confined himself to reprinting it from the "Elekto-technische Zeitschrift" in "L'Industrie Electrique," No. 57, with my consent, and with the express mention of my name.

Max Meyer.

Nüremberg, Germany.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM PRINCIPAL FOREIGN ELECTRICAL JOURNALS

BY CARL HERING

ELECTRO—PHYSICS.

Leyden Jar Discharges.— A British Association paper by Lord Kelvin & Mr. Galt on "Preliminary Experiments for Comparing the Discharges of a Leyden Jar through different Branches of a Divided Channel" is given in abstract in the Lond. "Elec. Eng." and Lond. "Elec. Rev." August 17.

A New Discharge Phenomenon.—According to the "Zeit. feur Elek.", July 15, Mr. Pilschikow observed that when the positive pole of a Voss machine is connected with a metallic point and placed over a vessel containing castor oil connected with the negative pole, a depression will be formed in the surface of the oil below the point; a screen placed between the point and the surface will cause the opposite effect, being similar to a shadow of the screen, the point being the source of light; the same takes place when the point is made the negative pole. A reference to what appears to be the same phenomenon was given in the Digest May 12.

Mechanical Effect of Electric Waves.—The article by Mr. Lebedew, mentioned in the Digest August 25, is abstracted more fully in the "Elek. Zeit.", August 16.

Explanation of the Ferranti Phenomena.—"The Zeit. feur Elek.," August 15, reprints a paper by Dr. Sahulka, in which he gives a mathematical and an experimental proof of the fact that the phenomena is due to the so-called magnetic leakage in the transformer; the same paper was abstracted in the Digest January 20.

Formation of Floating Metallic Films.—The Lond. "Elec. Eng.," August 17, abstracts briefly a paper by Messrs. Mylius & Fromm from the "Ann. Phys. Chem."

Atmospheric Electricity.—A paper on "The Electrics of the Atmosphere" by Mr. Walker, is published in the Lond. "Elec. Rev.," August 17. He quotes from different sources and mentions observations of his own; he states that there is in the electric state of the atmosphere a condition which must so profoundly affect the health of the people that we cannot afford to postpone its thorough investigation; he believes that there is no doubt that in much that has been written and discussed in the past, observers have been unintentionally confusing different causes and effects.

A British Association paper by Lord, Kelvin, Messrs. Maclean & Galt, is published in abstract in the Lond. "Elec. Eng." and Lond. "Elec. Rev.," August 17; the title is "Preliminary Experiments to find if Substraction of Water from Air Electrifies It." The experiments do not seem to be conclusive.

Flowing Electricity.—A publication by Dr. Stricker & Mr. Deutike is noticed in the "Zeit. feur Elek.," July 15, and appears to be recommended highly to those who are interested in theory as well as in practice. They appear to prove that in every closed circuit there exist two currents flowing in opposite directions, one a current of positive and the other a current of negative electricity, each flowing with gradually reducing tension and intensity. Among other things they state that Volta's fundamental experiments depend not on the contact but on the approaching or receding of the heterogeneous metals, the source of the current being the mechanical work exerted by the experimenter; they claim that the ions do not migrate through the whole electrolyte; their deductions appear to be based on experiments.

MAGNETISM.

Terrestrial Magnetism.—A British Association paper by Prof. Schuster, is published in full in the "Lond. Elec.," August 17; the subject is "A Suggested Explanation of the Secular Variation of Terrestrial Magnetism." He states that it is important to ascertain whether we must consider interplanetary space to be a conductor of electricity or not, and the object of his paper is to give some numerical calculations referring to the magnitude and nature of the reactions which would follow such a conductive property; the results of his investigations are that the mechanical reaction on the earth of currents induced in space, are insufficient to produce an appreciable lengthening of the day in historic times, unless the conductivity lies within certain narrow limits; and the magnetic reaction of the same current, in conjunction with the secular cooling of masses of iron inside of the earth, tend to produce a displacement, which is the same in kind as that observed in the secular variation.

The British Association paper of Prof. Rucker is abstracted briefly in the Lond. "Elec. Rev.," August 17.

Manganese Steel.—In an Academy note by M. Le Chatelier, published in "L'Ind. Elec.," August 10, he gives the results of some experiments with manganese steel made of an alloy of iron with 13 per cent. of manganese; this metal is not magnetic and has the highest resistivity of any alloy of iron, it being about one ohm per meter for one mm. in diameter; there is an allotropic property of this alloy which is magnetic; he describes how one form may be changed into the other by means of heat; the resistance of the two varieties is given for different temperatures showing that the two curves meet at 750° C, which is the same temperature as that at which soft iron passes from the magnetic to the non-magnetic state.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Simple Electrical Method for Testing Dynamos and Motors.—In the "Zeit. feur Elek.," July 1, Mr. Lenz describes a method for testing a dynamo or motor without the use of a dynamometer or a duplicate machine as in the Hopkinson method, and without the assumption that the efficiency of motor and dynamo are the same; it is a purely electrical method in which none but electrical measurements need be made. The description is not very clear and does not appear to be quite correct; the following is a translation of the essential parts. The motor is first run unloaded and the required watts L_m are measured; it is then coupled mechanically with any convenient dynamo; a second measurement of the energy required by the motor is then made while the field of the unloaded dynamo is excited; the exciting current of the dynamo need not be known but should merely be kept constant; deducting this from L_m gives the power L_d in watts, which is consumed in the motor to overcome the passive resistances and the hysteresis losses in the dynamo; this loss, as also the measurement in the first test, can be taken as constant for the same speed and the same excitation; a third set of tests is then made with different loads on the dynamo; the excess of power used in the motor, that is, after that in the second test has been deducted, is designated by L_e, the energy generated in the dynamo (it is not quite clear what is meant here), including the C_2R loss in its armature, is designated by L_e, and the quotient $L_e \div L_z$ is designated by E with subscripts for the various loads; on a system of co-ordinates the abscissas are made equal to $L_m + L_d + L_z$ and the corresponding co-ordinates $L_e \div L^z$, forming a curve which is nearly a straight line parallel to the abscissas, especially so for small loads; if E' is the value (of what?) corresponding to the smallest loads and if this be made equal to E_e for $L_e = O$, an assumption which the parallelism of the curve admits, that is, if it be made equal to $L_e = L_z$, for the dynamo when not loaded, then the electrical equivalent of the mechanical power delivered by the motor in the second test becomes known; if the above assumption that the ratio of the various values of the quotients $L_e \div L_z$, are equal for two loads not differing greatly from each other is correct, then L_d, $E_o = L_x$; the correctness of this assumption is proved by the curve; from these measurements the efficiency of the motor for each of the loads can be determined, as the power absorbed by it is equal to $L_m + L_d + L_z$, and the power delivered by it is L_d, $E_o + L_e$, the efficiency being therefore their quotient of the second divided by the first. For testing a dynamo it must be driven by a motor, for which the $L_e \div L_z$ curve is determined as described above; it is not necessary to determine the loss in the armature when only the efficiency is to be measured. For machines of small power, as for instance, ventilator motors, this system is said to be especially applicable; if, for instance, a one h.p. motor is tested with a dynamo of 100 to 200 watts, the power for no load and the power delivered can be measured with great accuracy with electrical measuring instruments. He calls attention to the fact that great care must be taken with the measurement of the speed, as the power at no load can readily be changed 15 per cent. merely by the pressure of the speed indicator.

Graphical Calculation—A British Association paper by Mr. Trotter on "A Graphical Transformer," is published in full in the Lond. "Elec." and Lond. "Elec. Rev.," Aug. 17; it is intended for replotting a curve with transformed ordinates, without calculation or scaling and consists of a retangular frame, a curved template and a straight rule. He also shows how it can be used for obtaining the product or quotient of two curves by adding or substracting the logorithms of the ordinates.

Construction of Delicate Galvanometers.—A British Association paper by Mr. Schuster is abstracted in the Lond. 'Elec. Eng.," Aug. 17; he compares the theoretically best way of winding the coils with that in which the coils are rectangular, both with uniform wire and wire of increasing diameter, obtaining the figures 1.60, 2.14 and 2.00 respectively for the three methods, the figures being proportional to the smallest current; he concludes that the advantage gained by winding in the theoretically best manner is therefore not very marked.

Instruments for Instruction.—An article in the "Elek. Echo," July 28, describes and illustrates a number of such electrical instruments; a new

form of galvanometer for lecture purposes is described in the issue of Aug. 4.

Test of Dry Cells.—The Lond. "Elec. Rev.," August 17, publishes in full a recent report of Prof. Jamieson on some tests made with the Obach and the E. C. C. cells, the dimensions of the two kinds of cells being about the same. The report contains a number of tables of the observed data; they demonstrate in most cases the superiority of the Obach cell. In an editorial discussion it is stated that the report is useful in showing how tests of that kind ought to be carried out; it endorses the conclusion to use as a unit of comparison the bulk of the cells, stating that "no other tests than that of taking cells of a similar size can be really of value." (With the exception of comparatively few cases, the user of such cells is concerned with the relative costs and behaviors of the cells, their bulk being of very little importance to him, as the space occupied by such cells is generally of little consequnce; it would seem therefore that the price and not the bulk would form a better unit of comparison).

DYNAMOS AND MOTORS.

Cast Steel and Cast Iron for Dynamos.—In an article by Mr. Schultz in the "Elek. Echo," Aug. 11, he calculates two dynamos differing only in the field magnet frame and field winding, in one of which cast iron is used and in the other cast steel. From curves he shows that with cast steel 12,000 lines of force per square centimeter (12 kilogausses) can be used and for cast iron 6,000, the former requiring 6.4 ampere-turns and the latter 28 ampere-turns per centimeter length of magnetic circuit; his calculations show that 5,800 ampere windings would be required for the cast iron as against 3,330 for the cast steel magnets. His conclusions are that the weight of the magnet frame will be reduced to one-half, and the weight of the copper for the magnets to somewhat less than one-half, in the cast steel magnets; the price of the steel is about twice as great, but on account of the reduction in the amount of copper the machines will be cheaper; he adds that there is a disadvantage in that cast steel is of such widely differing qualities and can therefore not always be relied upon without special testing.

ARC AND INCANDESCENT LIGHTS.

Ignition Produced by Incandescent Lamps.—A number of experiments are cited in a note in the "Zeit. feur Elek.," July 15; when covered with a layer of explosive powder, changes take place in the powders, some of them losing their sulphur, but none being ignited; the heating effect is increased by the proximity of heat non-conducting materials; when the lamp cracks or is broken, there is claimed to be considerable danger as it will ignite a mixture of explosive gases, although it will not ignite gunpowder; it is concluded that there exists a possibility of danger and it is therefoie not safe to bring lamps too near to combustible materials.

Electric Lighting from Balloons.—According to "L'Elec.", Aug. 11, the German Government is experimenting with this system for the lighting of battlefields or districts for military manœuvers; a light of 5,000 candles is said to be sufficient to light an area of about 500 meters in diameter in a hazy atmosphere, the light being 600 meters high; the source of the current, which is on the ground, is connected by cable with the balloon; the experiments were satisfactory and it is probable that the system is being used at the present manœuvers.

Etching Glass Bulbs.—The "Elek. Anz.," July 29, gives the following receipt: 36 grams sodium fluoride dissolved in one-half litre of distilled water after which 7 grams of potassium sulphate are added; a second solution is made of 14 grams of zinc chloride dissolved in half a litre of distilled water to which is added 65 grams concentrated hydrochloric acid: both liquids may be kept in glass bottles; to use them, equal volumes of the two liquids are mixed in a hollow block of paraffine to which some India ink is added to make the design visible; it is stated that the finest hair lines can be etched with this liquid.

Leading-in Wires.—The "Elek. Anz.," Aug. 2, states that an alloy of 25 parts of tin with 5 parts of copper has the same expansion co-efficient as glass and can be fused to the glass; the addition of ½ to 1 per cent. of lead or zinc will make the material softer or harder.

Lamp Shades.—The Lond. "Elek. Eng.," Aug. 10, mentions that a London firm is introducing some artistic shades made of natural feathers dyed and arranged in artistic combinations; they are illustrated in the Lond. "Elec.," Aug. 17.

ELECTRIC RAILWAYS.

Douglas-Laxey.—A brief description of this railway is given in the Lond. 'Elec. Eng.," and Lond. "Elec.," Aug 17, several illustrations being given in the former. One of the interesting features is in the use of a batch of 24 cells of accumulators placed near the line several miles from the station; it is charged directly from the line, or from a motor generator of special design which gives the required additional pressure; it not only gives the extra power required at times of maximum demand, but during the winter months it is intended to run all the cars, being charged only once or twice a week as occasion may require. Instead of the trolley wheel the current is collected by two horizontal bars the width of the car, one being placed at each end; they take the current by rubbing against the wire. The line was designed by Dr. Edward Hopkinson. (Some further information is given elsewhere in this issue.)

European Electric Railways.—The Lond. "Elec. Eng.," Aug. 10, begins a summary of data regarding European electric railways, beginning with that at Aix-la-Chapelle and at Hamburg.

Trolley Lines.—A paper by Dr. Rasch is published in the "Zeit. feur Elek.," July 15 and August 1; he discusses a number of calculations regarding motors, regulation, etc., giving simple formulas.

Double Trolley System.—The Lond. "Elec.," Aug. 17, reprints from an American journal a paper by Mr. Perry, and in an editorial comment appears to advocate the double trolley system

Budapest Underground Railway.—According to the Lond "Elec," Aug. 7, the concession for the construction of this line has been granted; it is to be opened April 1, 1896, and will be two miles long.

Mont Saleve.—An illustrated description of this electrical mountain road is published in "La Nature," July 7

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Some Advantages of Alternating Currents.—A British Association paper by Prof. P. S. Thompson is reprinted in full in the Lond. 'Elec. Eng.," August 17. A full abstract of this paper will be found in The Electrical World of September 1.

Various Methods of Charging for Current.—In an article by Mr. Gibbings, in the Lond. "Elec. Rev.," July 27 and August 3, he calls attention to the fact that the success of a station will depend very largely on the method of charging, and discusses in detail the various methods which have been used and proposed. Omitting the system of a definite charge per year per lamp, he divides the methods into three, discussing each in detail. The first consists of separate charges for lighting current and for motive power, registered by separate meters; it is not an economical arrangement, as the lights may be used in the daytime and the motors during the time of maximum demand; double meter rental must be charged and there is no inducement to the public to use current for lighting in the daytime; the advantages are that the consumer knows the actual price and that the lower price for motive power induces the use of electricity for that purpose. In the second method there is one general charge with rebates on a large consumption; he states that no one system must, or probably will be, the best everywhere, as the character of the district makes a great difference; among the arrangements for rebates are (1) a rebate deducted from the last quarterly payment and based on the annual bill; a scale of rebates corresponding to a table of units for each lamp installed; (3) a combination of these two; (4) a maximum price up to a total equal to a consumption of 8 units per 8 c. p. lamp wired and a minimum price for every unit above this; (5) a sliding scale charge per unit on the absolute number of units consumed. The first and second must be combined in order that there may be a legitimate basis for granting a rebate; the peaks in the load line may be due to the very customers who get the largest rebates and who consequently pay the smallest price per unit, but with the combination of the two systems some guarantee is assured that the demand is used for a considerable time per day; but it does not encourage those who use current during the day only; the fourth arrangement is similar but simpler and is claimed to be very satisfactory in a station in which it is used; it has the tendency to eliminate a most undesirable class. The third general method is to have a maximum charge based on the number of hours during which the demand is used, all excess being charged at a half or a different rate; the Wright system, which belongs to this class, is discussed; it consists in placing a recording ammeter in series with the consumer's meter, which registers the maximum amount used at any given time; it induces the consumer to use the greatest number of units for the smallest amount of current, thus effecting his own reduction; it tends to increase the day load, as it induces the consumer to use the current for motive power and other work during the day; consumers are all on an equal basis, whether their demand is large or small; the disadvantages are that it does not guarantee at what time of the twenty-four hours the number of units are consumed for which the full price is charged; it is unfair that he should be charged the lower rate if the current is used during the time of heaviest demand; the greatest disadvantage, and a very serious one, is that the indicator registers the absolute maximum demand at any one time; if for instance, the exceptional maximum is double, then double the number of units must be used throughout the year to effect the reduction; the method, however, approaches more nearly a perfect system than any of the others. He then discusses the charging in a general way, considering the cost at the works and the public interest, and offering a solution, he calls subsidiary charges those items which would not practically be increased by generating the remaining seven-eighths of the available output of a station in which one-eighth of the absolute capacity per year was used; those of the consumers who use current at the time of maximum demand, should pay for the net cost of generating the current, including all subsidiary charges, and in addition a minimum profit; the charge would be 10 cents per unit of one kilowatt-hour; those who require current at other times should pay the cost of generating, but not including the subsidiary charges; this he gives as 2.4 cts. per unit, to which he proposes to add the larger proportion of the company's estimated profits, which he gives as 3.6 cents per unit. In the conclusion in the issue of

August 10, he considers the attitude of the public to each of the three methods given; the first has the merit of being definite, but the demerit of being exceedingly unpopular; it is essentially the small consumer's system. The second system is wanting in definiteness, the consumer being in the dark as to what abatement he will have, and it is one sided, being satisfactory to the station but not to the consumer. Regarding the third system, he states that it would be satisfactory if it were possible to apply the system so that daily instead of quarterly records were taken. An ideal system should embody the following points: the charges per unit should be definitely fixed irrespective of the amount; records should be based on daily and not on quarterly consumption, the higher price should be charged only during the hours of maximum demand; these hours should be definitely fixed; no rebate should be allowed; only one pair of leads should be required; an automatic arrangement will be required to register the current consumed at the higher and lower prices. Under the ideal arrangement of such an apparatus he describes that suggested by Kapp, in which a clock controlled and rewound by means of Leclanche cells inserts or cuts out a shunt to the meter at the hours when the price changes, the shunt being calibrated by means of an amperemeter to conform to the ratio of the different prices; the device can be used with any existing meter and the original cost is said to be about $15 per consumer, in addition to which it is stated that it would be necessary to supply only those consumers who use the light for long hours.

Commercial Efficiency of Accumulators.—An article in "L'Ind. Elec.," August 10, gives the results of carefully kept records of the input and output of accumulators in constant use at the Clichy sector in Paris during the first five months of the present year. The battery consists of two sets of 250 cells each; the total weight of plates in a cell is 330 lbs., the normal output 250 amperes and the corresponding capacity 2,000 ampere-hours; the necessary increase in voltage for charging is obtained by means of a separate dynamo. A table is given containing the monthly charges and discharges in watt-hours and the efficiency for each month, the mean of which is 69 per cent.; there is an increase of efficiency every month, the efficiency for May being about 72 per cent.; the mean daily output is about 1,500 ampere-hours, which represents 75 per cent. of the capacity at the normal output, which output is often exceeded; the minimum output per day is 70 per cent. of its capacity.

Continuous Current Distribution at High Voltage—A British Association paper by Mr. Parker is publised in full in the Lond. "Elec. Eng.," August 17; it is a description of the lighting of the city of Oxford; the generating station is situated 1,500 yards from the center of the lighting district; continuous currents of about 2,000 volts are produced and are transformed in 5 sub-stations by 7 motor transformers, which are said to be controlled by one man; a storage battery is installed at one of the sub-stations, supplying about one-twentieth of that load from one o'clock in the morning until an hour after sunset; it is charged from the mains with an additional motor generator which adds about 33 volts. Some detailed figures concerning the cost and output are given, among which it is stated that the total efficiency between the generated and the metered energy is 62.6 per cent.; the all-round efficiency of the transformers is 76.7 per cent. including the losses in the mains; the battery efficiency is 43.9 per cent.; the coal is 6.43 lbs. per kilowatt-hour sold.

Power Distribution Installation.—"L'Elec.," August 18, gives an illustrated description of an installation in a large factory in which the transmission by shafts and belts has been replaced by an electric system with individualom tors.

Arundel Castle.—The Lond. "Elec. Eng," Aug. 17, gives a brief description of this plant, which is said to be one of the largest private installations in the country; the illustrations show only the architectural features.

Accumulator Station at Eccles.—A report by Dr. John Hopkinson in which he recommends an accumulator station in that town, is published in the Lond. "Elec. Eng.," Aug. 17.

Manchester.—The switchboards at this station are illustrated and described in Lond. "Electricity," Aug. 3.

Train Lighting.—A descriptive article with some illustrations is given in the "Elek. Echo," Aug. 11.

Regulating Gas Engines.—In an article by Mr. Picou in "L'Ind. Elec.," Aug. 10, he discusses the various means used for damping the irregular action of gas engines when they are used for electric lighting; the variations in speed are at present still so great that they form a serious obstacle to the use of gas engines for lighting; the application of accumulators in derivation is not discussed. He gives the theory of an elastic transmission inserted between the gas engine and the dynamo and shows that this system is worse than nothing, as the irregularity in the running of the dynamo is thereby increased. In discussing fly-wheels, theoretically, graphically and by means of an example, he shows that their use is beneficial when they are placed on the engine, but that a limit to weight is rapidly reached; to place them on the dynamo will not remedy the evil entirely, as has often been supposed, their effect being then inappreciable; it is, however, not entirely useless. The only method at present in use which is effective is therefore to place a fly-wheel on the gas engine. He also suggests the use of the fly-wheel of Mr. Raffard, which has a variable inertia, as the masses of metal displace themselves readily against the action of centrifrugal force, being retained by springs; for a given mass a much larger storage of power can thus be obtained for the same variation of velocity; the idea itself is not new. Another method which he suggests is the storage of part of the energy in a sort of spring, using, say the compression of air; curves are given for an engine with and without such a device.

The Hunting of Governed Engines.—A British Association paper by Mr. Swinburne is published in full in the Lond. "Elec. Eng.," Aug. 17

WIRES, WIRING AND CONDUITS.

Mechanical Calculation of Leads.—A simple and ingenious apparatus is described and illustrated in the "Elek. Echo," Aug. 4, for determining the cross section of leads for a given loss in volts or vice versa, for any groups of lamps at any distances; it consists essentially of a balance beam on which weights proportional to the number of lamps are hung at distances proportional to the actual distance of the lamps; the other end of the beam then indicates on a dial the required cross-section.

Wire Coupling.—In a note on the Arld coupling in the "Zeit. feur Elek.," Aug. 1, it is described as consisting of a sleeve, into which the ends of the wires to be coupled are run, after which the sleeve is twisted and the projecting ends bent over; experiments showed that there was no oxidization in the inner part of the tube; when subjected to tensile strength the rupture did not take place in the coupling itself; by making the tube large enough to slip over the insulated wire it can be used for making branch connections by flattening it, then inserting the branch wire and twisting it as before.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Signalling Through Space—A British Association paper on this subject by Mr. Preece, is published in full in the Lond. "Elec.," "Elec. Rev." and "Elec. Eng.," Aug. 17. He discusses the subject in general and also the effect of the earth's conduction; he refers briefly to experiments across the Kilbrannan Sound, made between parallel lines on opposite sides, four miles apart, as also between loops 500 ft. high and five miles apart; he states that the distance to which the effective field formed by a coil extends, increases with the diameter of the coil more than with the number of turns of wire; among the different systems he finds that the best practical results are obtained with single parallel wires connected to the earth at each extremity, especially if the wires are carried to a considerable height above the sea, the earth plates being at the sea level, that system being better than the use of parallel coils or coils placed in the same plane; the question of the practicability of effecting communication he believes is now solved; he refers also to signalling across planetary space. In the appendix he gives a formula by Mr. Kemp for making calculations of such induction; in a second appendix a paragraph from "Nature," April 12, is given, referring to observations made on some lines during a recent magnetic storm of considerable magnitude.

Coast Communication.—According to the Lond. "Elec Rev.," Aug. 10, the Royal Commission who are examining systems of coast communication, have concluded that the "sunk" system, which has now been applied to the Goodwin and Kentish Knock lighthouses, is preferable to all the others.

Induction Telegraphy.—In an editorial in the Lond. "Elec. Rev.," Aug. 10, the article mentioned in the Digest, Aug. 25, is abstracted, but without comments. The issue of Aug. 17 contains a short article, giving, however, nothing new.

Production of Extra Currents.—An apparatus is described at some length and illustrated in the "Elek. Anz.," Aug. 9, for generating extra currents so that they can be used as alternating current impulses; the chief application is in telegraphy, in which one or two volts are used in place of a large number of cells for telegraphing to distances up to 160 miles.

ELECTRO-CHEMISTRY.

Preparing the Solution for Accumulators.—In an article by Mr. Sayers in the Lond. "Elec.", Aug. 10, he describes the preparation of four tons of acid; slate was used for the mixing tank, two days were allowed for the mixing and three days for the cooling; tests showed the presence of arsenic, which was eliminated by sulphurated hydrogen by a process which he describes. Whitening, he claims, is better for soaking up any spilled acid than soda, ammonia or sawdust.

Regeneration of Accumulator Plates.—The peroxide plates, after some usage, become soft and the material is apt to detach itself; to restore the oxide to its original state Mr. Epstein, according to La Lum. "Elec.," Aug. 4, dries the plates, then reduces the oxide by a negative current, then re-oxidizes them again by a positive current.

Bi-products with Useful Primary Batteries.—The "Elek. Echo," July 21, gives an article by Mr. Oppermann, in which he makes a number of suggestions for the construction of primary batteries whose bi-products are of value.

Electrolysis of Mixtures of Salts.—An article by Mr Houllevigue is abstracted at some length in "La Lum. Elec.," Aug. 4.

Electrolysers—Those of Craney and Lienard are described and illustrated in "La Lum. Elec.," Aug. 4.

Chlorine and Soda.—According to the Lond. "Elec.," Aug 17, the Ger-

man Solvay Co. is about to use the electrolytic system for the production of caustic potash, chlorine and chlorite

Manufacture of Soap.—The Parker & Robinson process is briefly described in the "Elek. Anz.," Aug. 16; ordinary salt is electrolyzed, the fatty or oily material being brought in contact with the pole on which the alkali is set free; the soap thus formed floats and can readily be removed.

Manufacture of Varnish.—The "Elek. Anz.," Aug. 5, gives briefly the Pfann receipt in which pure linseed oil is mixed with water and sulphuric acid, and then subjected for two or three hours to an electric current passing from the vessel to the stirring apparatus; intimate mixing is essential.

Electric Tanning.—The Humy system is briefly described in the "Elek. Anz.," July 29.

Nickel Plating Baths.—Eleven receipts, taken from a German publication, are given in "Elec.," Aug. 18.

Precipitation of Metals.—The Lond. "Elec. Rev.," August 10, in an editorial, gives the conclusions from a paper by Messrs. Mylius & Fromm from a German chemical paper; among other things it is stated that the black precipitate formed on the zinc of a Daniell cell consists of a copper-zinc alloy.

MISCELLANEOUS.

Flying Machine.—The 'Zeit. feur Elek.," July 1, gives a brief illustrated description of the paddle-shaped wheel to be used in the Wellner flying machine mentioned in the Digest, Feb. 24; it consists of 8 large paddles linked to two eccentric centres so that the inclination of the paddles changes in accordance with their positions in different parts of their revolution; it appears that it will be driven by an electric motor; the wheel has just been finished and is being erected in Vienna for making a practical test; the wheel weighs 352 lbs. and is intended to lift 330 lbs. additional; it is thought that the speed of transit will be much greater than that of the fastest locomotive; the experiments are in charge of the Austrian Society of Engineers and appear to be exciting great interest among engineers.

Electrically Driven Balloon.—The "Zeit. feur Elek.," August 1, gives the following data about the balloon at the Antwerp Exhibition, already described in these columns (see Digest Januury 27 and May 26). It is 85.5 meters long, 17.5 meters wide and is cigar-shaped; its volume is 13,373 cubic meters and will carry a total of 9,800 klgr. of which 4,400 is the weight of the balloon and the gondolas, 2,210 that of the machinery and the remaining 31,150 that of the passengers, crew and ballast; the gondola is 50 meters long and 2.5 meters wide, is completely enclosed and is elaborately finished inside; it will carry about 25 passengers; the electric motor develops 125 h. p., and drives a screw propeller 8 meters in diameter; the trolley line consists of wires having a total strength of 75,000 kilograms and runs through the city on poles about 100 ft. high. The balloon will ascend to a height of about 1,000 ft. and travel a distance of 2.1 miles.

Purifying Graphite or Carbon—A purifying process is described briefly in the "Elek. Tech.," July 31; the graphite is ground to a fine powder mixed with chlorate of potash or chlorate of soda in the proportion of 18 to 1, after which sulphuric acid of 1.8 sp. gr. is poured over the mass in the proportion of 2 lbs. of acid for 11 lbs. of graphite; the mixture is heated moderately until no more vapors arise; the chlorine evolved forms soluble salts of the metals which are contained as impurities in the carbon; to free it from silicates it is treated with sodium flouride.

Improved Carbons.—When heated to very high temperatures the various kinds of carbons pass into the graphitic condition, according to the Lond. "Elec. Rev.," Aug. 10; Messrs. Girard and Street have applied this to the manufacture of graphitic carbon; for electrical purposes the temperature is produced by an electric current or by the arc, in which the ordinary carbon will soften, weld and even fuse and sublime.

Motors vs. Belts.—According to "La Lum. Elec.," Aug. 4, the locomotive works at Dusseldorf have been using electric motors for almost a year in the foundry, resulting in a saving of about $5,000 per year over the former method of using belts and intermediate transmission.

Application of Power in Bridge Building.—In the "Elek. Zeit." August 2, Mr. Rohde gives an illustrated description of an interesting application of electric power for operating traveling cranes in the construction of what is to be one of the largest arch bridges; electric power was resorted to to facilitate the work and to enable the steam engine to be placed at some distance from the structure; series motors of 7 h. p. are used, the generator being a compound dynamo; in order to prevent the circuit from being opened completely by the stoppage of the motors, an automatic apparatus is used, which inserts a dead resistance at such times.

Electrification of Explosive Powders.—The Lond. "Elec. Rev.," July 27, in an editorial calls attention to the fact that such substances become highly electrified if exposed to friction in the course of manufacture or handling, but if they be glazed with graphite, the particles become conductive and the electrification does not take place; it has been claimed that many of the mysterious explosions may be traced to the ignoring of this electrification; in Government factories it is the rule to exclude or cover all metallic surfaces, but this converts the shed, in effect, into a large Leyden jar; to prevent this all metallic surfaces should be properly earthed.

Fire Damp Detector.—In the Fletcher detector, described briefly in the Lond. "Elec. Rev.," Aug. 10, a platinum wire is contained in a tube of wire gauze and another in a sealed tube containing air; when a current is passed through both they will glow with equal brilliancy in air, but when in an atmosphere of inflammable gas, the spiral in the wire gauze tube will glow more brilliantly, the brilliancy being in proportion to the amount of gas; by means of an ingenious arrangement similar to that of a photometer, the actual percentage of dangerous gas can be calculated.

Locating Underground Watercourses by Means of Electricity.—In an apparently serious notice in the "Zeit. feur Elek.," July 1, an Austrian nobleman, von Sedczicz, is said to have located 3,000 sources of water in all parts of the world with but 12 failures, by means of electric apparatus, somewhat indistinctly described but apparently consisting of platinum chains and balls worn on the body, one end of the platinum chain terminating on the finger, another connection being with a platinum plate on the foot; the other hand holds a magnet and a watch; in walking over a place where there is water in the ground one of the balls "becomes active" and follows the water course, indicating also the depth. The article adds that he also makes a careful study of the topography and geology of the district, which "facilitates" his work.

Physiological Effects of High Frequency Currents—. In reply to a statement made in a paper by Dr. Morton, of New York, Mr. Swinton states, in the Lond. "Elec. Rev.," Aug. 10, that at present no instruments exist that are capable of measuring even approximately, the correct amperage or voltage of Leyden jar discharges, and that therefore any conclusions based on them are misleading.

Electrocution.—A paper by Mr. de Fonvielle, read before a French society, is published in full in 'La Lum. Elec.," July 28; in it he discusses electrocution, arguing in favor of it and recommending its adoption in France.

A Synchronic Photograph.—Under this heading the Lond "Elec. Rev.," Aug 17, publishes a curious photograph of a large Ferranti fly-wheel alternator; the light was supplied by the alternating arc lights run from the dynamo itself; the exposure was for 10 minutes, during which time the fly-wheel made nearly 1,000 revolutions; from the photograph it seems as though the revolving field magnet and fly-wheel are stationary, being held in space, as no arm, or other means of support are visible; so perfect is the original photograph that one can count the windings on each of the many field magnet coils.

Electric Porcelain Muffles.—The Lond. "Elec. Rev.," Aug. 17, suggests that muffles for the firing of delicate porcelain wares might be used with success when electrically heated, as that would completely avoid the evil effects of the products of combustion of the fuel on the delicate glazes and colors.

Artificial Rubies.—The "Elek. Anz.," July 22, states that in France artificial rubies are made in large quantities intended specially for bearings in watches; they are made electrically by fusing clay with barium fluoride to which chromium salts are added to give the red color.

Copper Production.—The "Zeit. feur Elek.," Aug 15, reprints a paper compiled by a London firm, giving the copper production of different countries for the past four years; that produced in the United States was nearly half of the total production of the world.

Acid Proof Paint—. The "Elek. Anz.," Aug. 9, gives a receipt of Mr. Carrè; pure, finely pulverized asbestos is mixed with a small amount of syrupy solution of water glass, the plastic mixture obtained being thinned with a solution of water glass containing as little free alkali as possible.

Tinning.—According to the "Elek. Anz.," July 22, articles to be tinned are first electro-plated with an alloy of iron and nickel or cobalt, after which they are tinned as usual; the bath consists of nickel or cobalt sulphate, nitrate or chloride, sulphate of iron and citric acid.

Electricity on Ships.— A long serial by Mr. Gelcich has been running through a number of issues of the "Elek. Echo," on "The Application of Electricity on Ships During the Past Twenty Years;" the serial is concluded in the issue of Aug. 18.

Purification of Water.—An article by Mr. Oppermann on the electrical purification of water is published in the "Elek. Echo," Aug. 18.

Life Buoy.—An illustration of the one described in the Digest, Aug. 25, is published in "L'Elec.," Aug. 11.

Patent System.—The leading editorial in the Lond. "Elec. Rev.," Aug. 10, discusses the question of the examination of applications for patents, arguing in favor of the British system in which no examination is made, a patent being granted to the first applicant; it is claimed that the examiners are not always competent and that the interference proceedings are "a disreputable game;" the Edison lamp patent is cited as an example; it is claimed that there is no harm in granting a worthless patent, while to refuse a patent due to the examination of an incompetent examiner is manifestly unjust.

Lightning.—"La Lum. Elec.," July 28, abstracts briefly from a recent work by Mr. de Fonvielle, on aeronautics, in which a statement is made that it is a mstake to believe that balloons cannot be struck by lightning, as recent observations have proved that flying birds are susceptible to being struck by lightning during a storm.

Old Steam Engines.—"La Lum. Elec.," Aug. 4, extracts briefly from a work by Prony published in Paris in 1826 on "The New and Old Steam

Engines at Paris, etc.;" the book contains a description of the well-known Prony brake.

Keely Motor.—In an article of some length in the Lond. "Elec. Rev.," Aug. 10, the Keely motor and the writings of Mrs. Bloomfield Moore are discussed.

Electrical Quilt.—According to the Lond." Elec. Rev.," July 27, an exhibit at the Royal Society consisted of a quilt or cushion containing a resistance wire, in which warmth may be produced by an electric current; it is suggested to use this in hospitals, especially in cases of surgical operations. The Lond. "Elec. Eng.," July 27, contains a somewhat more complete description.

British Association Meeting at Oxford.—In the Lond. "Elec.," Aug. 7, is published a list of the electrical papers read at the meeting accompanied by an account of the meeting for each day; a general discussion of the meeting is published in the Lond. "Elec.," which contains also an editorial on the Mechanical Section. A large number of the papers are contained in the English journals of Aug. 17, specific references to which will be found above under the divisions to which these papers belong. Some criticisms of the terms used are made in the Lond. "Elec.," Aug. 17. The attendance was 2,321, which was several hundred in excess of last year's meeting. Lord Salisbury's and Prof. Rucker's Presidential addresses are published in the Lond. "Elec.," and "Elec. Eng.," Aug. 10. The address of Mr. A. B. W. Kennedy on "The Critical Side of Mechanical Training, and the paper by Sir Frederick Bramwell on "Some Reminiscenses of Steam Locomotion on Common Roads" are published in the Lond. "Elec. Eng.," Aug. 10; the former is published in full in the Lond. "Elec.," Aug. 17, and is discussed editorially in the same issue; the Lond. "Elec.," Rev.," also criticises and discusses the paper.

Prizes.—According to the Lond. "Elec., July 27, handsome' prizes are offered in connection with the Paris Exhibition of 1900 for the solution of three elementary problems; the transmission of sight to a distance, chromo-photography on paper and electric lighting without focus by cold light with the aid of electric undulations of great frequency. A list of the prizes offered by a French Sociey, are given in "L'Ind. Elec.," July 25, and "L'Elec.," Aug. 4 and 11, and those of another society in "L'Elec.," July 21.

Biographical.—A biographical sketch of the late Prof. August Kundt is given at some length in the "Elek. Zeit.," July 26, the Lond. "Elec.," Aug. 10, publishes a steel portrait and a biography of the late Heinrich Hertz.

La Lumiere Electrique.— The publication of this French electrical journal has been suspended for the present. The directors hope to be able to resume the publication of it at some future day. The first number was issued April 15, 1879, and the last one received at this office was issued August 4, 1894; according to a statement of the directors it has been published at an annual loss of $14,000.

Moonlight Tables for October, 1894.

Herewith we give Mr. H. W. Frund's tables of lighting hours for the month of October under his modified form of moonlight schedule.

TABLE NO. 1.
Standard Moonlight System.

Date.	Light.	Date.	Exting.
1	6.10 P. M.	2	5.00 A. M.
2	6.10 "	3	5.00 "
3	7.00 "	4	5.00 "
4	7.50 "	5	5.00 "
5	8.40 "	6	5.00 "
6	9.40 "	7	5.00 "
7	10.40 "	8	5.00 "
8	11.40 "	9	5.00 "
9			
10	12.40 A. M.	10	5.10 A. M.
11	1.50 "	11	5.10 "
12	2.50 "	12	5.10 "
13	3.50 "	13	5.10 "
14	No light.	14	No light.
15	"	15	"
16	5.50 P. M.	16	7.10 P. M.
17	5.50 "	17	7.50 "
18	5.50 "	18	8.40 "
19	5.40 "	19	9.40 "
20	5.40 "	20	10.50 "
21	5.40 "	22	12.00 A. M.
22	5.40 "	23	1.20 "
23	5.40 "	24	2.30 "
24	5.40 "	25	3.50 "
25	5.40 "	26	4.50 "
26	5.30 "	27	5.30 "
27	5.30 "	28	5.30 "
28	5.30 "	29	5.30 "
29	5.30 "	30	5.30 "
30	5.30 "	31	5.30 "
31	5.30 "	1	5.30 "

Total No. of hours, 211.30.

TABLE NO. 2.
Frund's New Moonlight System.

Date.	Light.	Date.	Exting.
1	6.10 P. M.	2	5.00 A. M.
2	6.10 "	3	5.00 "
3	6.10 "	4	5.00 "
4	6.10 "	5	5.00 "
5	6.00 "	6	5.00 "
6	6.00 "	7	5.00 "
7	6.00 "	8	5.00 "
8	6.00 "	9	5.00 "
9	6.00 "	9	12.00 M.
10	12.40 A. M.	10	5.10 A. M.
10	6.00 P. M.	10	12.00 M.
10	6.00 "	11	"
11	5.50 "	12	"
12	5.50 "	13	"
13	5.50 "	14	"
14	5.50 "	15	"
15	5.50 "	16	"
16	5.50 "	17	"
17	5.50 "	18	"
18	5.40 "	19	"
19	5.40 "	20	"
20	5.40 "	21	"
21	5.40 "	23	1.20 A. M.
23	5.40 "	24	2.30 "
24	5.40 "	25	3.50 "
25	5.40 "	26	4.50 "
26	5.30 "	27	5.30 "
27	5.30 "	28	5.30 "
28	5.30 "	29	5.30 "
29	5.30 "	30	5.30 "
30	5.30 "	31	5.30 "
31	5.30 "	1	5.30 "

NOTE.—These schedules are made up on sun time. Where standard time is used, and it varies considerably from sun time, the proper deduction or addition must be made to all the times here given.

New Book.

DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By Edwin J. Houston, Ph. D. (Princeton). Third edition, greatly enlarged. New York: The W. J. Johnston Company, Ltd. 1894. 669 double column octavo pages, 582 illustrations. Price, $5.00.

A dictionary of this kind, while invaluable to the electro-technical expert as containing in a condensed space a very large amount of important information, appeals directly to the requirements of the reading public. Only a few years ago it was possible for even the well educated to practically ignore the nomenclature and terminology that at that time were rapidly developing among electrical experts, under the beneficent auspices of electrical science and art. To-day, however, this condition of affairs is changed, and so deeply has electricity entered into our every-day lives, so closely has it become associated with domestic requirements, and so inseparately has it become connected with every branch of useful and scientific knowledge, that it is absolutely impossible for any general reader, who aspires to the most mediocre standard of a liberal education, to ignore the terms, phrases and expressions in which electricity is universally expressed.

The fact that electrical science and engineering employ a common and universal language of units and measurement all over the civilized world, has had a great share in the rapid developement of an international code of language and an international development of ideas upon this subect. In this respect electricians are far more favored than any other branch of technical workers. for the terms and phrases which enter into the technology of any other subject are necessarily more or less local to the language and country where they are found indigenous, so to speak, to its soil. On the contrary, terms, phraseology and language which elecricians employ are far more nearly international, and the favor which this book has met with outside the United States, and even in countries where the English language is not the vernacular, is an evidence of this very fortunate condition of affairs.

It becomes absolutely necessary, therefore, that all who endeavor to keep pace with the rapid march of scientific and industrial progress should either so far familiarize themselves with the electrical nomenclature of the day as to permit them to follow without effort electrical applications and their descriptions; or, at least, to have at hand a book of this authoritive character, by which the explanation of any of the frequently recurring terms and phrases dealt with in electrical literature can be explained.

The very rapid growth of electrical industrial applications, as already referred to, has been fraught with one danger, namely, that the continual necessity for the introduction of new terms by which to express the perpetual growth of ideas should be carried out confessedly by those who care little for the proprieties of language or the precedents of forms of speech.

A perusal of this dictionary proves that we are largely indebted to its author for the efforts he has made to collate and compare various conflicting terms that have come into employment, showing the merits of some and advocating the dismissal of the more ill-chosen terms. The book, therefore, becomes immediately a standard of reference to those who are familiar with the various expressions employed, and the well-known philological attainments of the author have rendered him peculiarly fitted to execute the task he has undertaken.

The style in which the definitions and descriptions are given is not only popular, but complete, the language being such that while a clear and full description is offered upon all terms, even the most unfamiliar reader can readily comprehend them. A great difficulty in the preparation of a dictionary of this kind is either to err on the side of diffusiveness or of conciseness, and the treatment here presented appears to have followed a very happy medium.

One of the most important points in the plan is a system of cross-reference, which is fully developed. It is true that such a system of cross-references is not urgently needed by those who are familiar with electrical terms and phrases, who only seek exact definitions, but on the other hand to the uninitiated and general reader, who may be unfamiliar with the relative prominence of the various terms constituting a phrase, the cross references are of undoubted value.

The book is by far the most complete encyclopedia of electrical phrases that has ever made its appearance in any language. It will be found valuable alike to the scientist, the engineer, the therapeutist, the lineman, telegrapher, artizan, and general public. The third edition has received an appendix containing about 20 per cent. of the previous contents, and the book has been greatly enlarged. It is well printed in excellent type.

NOTE.

The contents of the Physical Review for July-August, 1894, the first number of a new volume, are up to the high standard which has characterized this periodical from the beginning, and, as usual, electricity takes up a goodly proportion of the space. The leading article is by Messrs. Clayton H. Sharp and W. R. Turnbull on "A Bolometric Study of Light Standards." The results of the experiments demonstrate the futility of any attempt to get concordant photometric results from freely burning candles unless with a very long series of observations; they also show the superiority of the English over the German candle, and that with the Hefner standard a very good average may be expected from a series of observations extending over a comparatively short time. Dr

Charles B. Thwing in a paper describes some experiments which establish to a considerable degree of probability that there is a definite relation between specific inductive capacity and the chemical constitution of matter. Among the minor contributions are an illustrated description of the physical laboratory of Adelbert College, and accounts of a laboratory experiment in simple harmonic motion by Mr. John O. Reed and of some experiments in electric photography by Mr. Fernando Sanford. Professors Sanford and Carhart have another bout in regard to the claim of the former that he has established the fact that the electrical conductivity of copper is affected by the surrounding medium. (Ithaca, N. Y.)

European Red Tape.

It is stated that the reason why a certain electrically driven carriage from Italy could not take part in the recent competition held in Paris, was that the French custom-house officials could not make up their minds what duty to charge for electrical carriages, and therefore could not admit this one into France.

A Large Electric Transmission Plant.

Contracts have been closed for a large two-phase transmission plant at Montmorency Falls, the current generated to be conveyed to Quebec, eight miles distant, for light and power purposes.

The Falls have a head of over 300 feet, altogether, one portion being a perpendicular fall of 268 feet, and for the past ten years a part of the water power has been utilized for supplying Quebec with current for lighting. The present plant consists of three 2,000 light single phase A. C. machines made by the Royal Electric Company, Montreal, and fifteen arc light machines with a total capacity of 600 lamps; the former generate current with a voltage of 1,800 at the Falls which drops to 1,000 volts at Quebec, and is used for supplying an ordinary lighting service.

Some time ago the Montmorency Electric Power Company decided to put in a modern plant, and, after investigating different systems, has finally ordered three 675 h. p. two-phase alternating generators from the Stanley Manufacturing Company, Pittsfield, Mass. The machines are to generate current at a voltage of 5,500, and the out-put of each will be carried, with a drop of 6 per cent., by four wires to a sub-station in Quebec, where step-down transformers will reduce to 2,000 volts, which will be the voltage of the distributing system. These transformers, which will also be furnished by the Stanley Company and aggregate 1,000 kilowatts in capacity, are to be placed in a sub-station built purposely for their reception and provided with very complete arrangements for keeping them cool by air blasts. The current will be used for lighting, general power distribution by two-phase A. C. motors, and for electric street railway power through the intermediary of rotating transformers. In the sub-station there will also be a very complete switchboard installation, including a switchboard for the railway service, one for the arc light service and one for the two-phase light and power service. The offices of the Company will also be in the same building.

The type of generator to be furnished is similar to that illustrated in the Electrical World of June 16, 1894, the main points of which are stationary armature and a revolving field or inductor containing no wire whatever. Another feature is that the form of curve of E. M. F. generator approximates very nearly to a sine curve, the advantages of which have recently been so strongly referred to in our columns. When the new addition is furnished, the Montmorency plant will be one of the most complete in existence, and much of the credit will be due to Mr. F. H. Badger, the general manager of the Montmorency Electric Power Company. Mr. Badger, who is a son of the City Electrician of Montreal, was with the Royal Electric Company for ten years, and is an electrical engineer of more than ordinary acquirements, He connected himself with the Montmorency Company on February 1, 1894, and much of the recent progressiveness and success of this company has followed from his able management.

Turbine Tests.

We are indebted to the Dayton Globe Iron Works Co., successors to Stout, Mills & Temple, Dayton, Ohio, for the results of some tests recently made at the Holyoke testing flumes, Holyoke, Mass., on a new line of its New American Turbine Water Wheels, in which the capacity has been greatly increased for each diameter. It is scarcely necessary to point out that high efficiency at whole water and low efficiency at part water does not constitute a first-class turbine, as it is impracticable to properly operate any kind of machinery without reserve power. A margin must be left for emergencies and for fluctuation of load, and it is claimed that the construction of the New American turbine is such that the highest efficiency is obtained at ⅞ to ¾ water, as seen by the following, which is copied from the official reports:

Test of a 45-Inch New American Turbine, July 9, 1894.

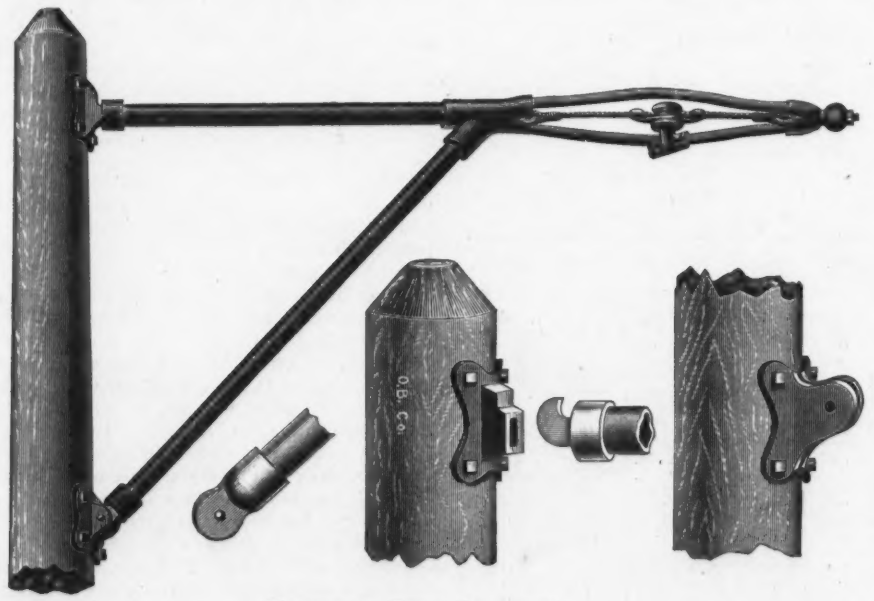
Whole Gate (meaning whole water)	79.76	per cent.
⅞ " "	82.58	"
¾ " "	82.18	"
⅝ " "	79.31	"
½ " "	75.52	"
Average efficiency from whole to half water	79.87	"

Test of a 42-Inch New American Turbine, July 14, 1894.

Whole Gate (meaning whole water)	80.50	per cent.
⅞ " "	83.09	"
¾ " "	82.77	"
⅝ " "	79.21	"
½ " "	70.60	"
Average efficiency from whole to half water	79.25	"

A Flexible Pole Bracket.

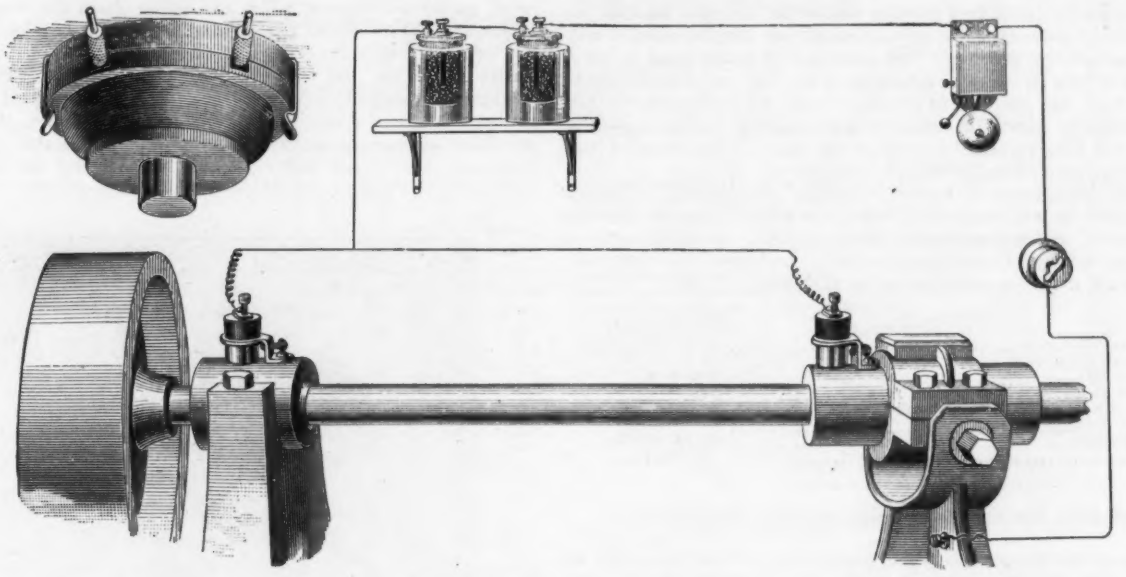
The Woods' flexible pole bracket, manufactured by the Ohio Brass Co., of Mansfield, Ohio, and of which we give an illustration, overcomes the hammering effect of the trolley wheel on the hanger that is due to the rigid construction ordinarily used on the regular pole bracket, and makes a yielding and flexible support, therefore allowing cars to be operated at a high rate of speed without the evil results heretofore experienced. It combines the best features of the cross and bracket suspensions, and the peculiar construction of the upper pole socket and hook allows the bracket to be easily swung into position and admits of adjusting the horizontal arm vertically. The straight line hanger is suspended between the curved arms on the steel strand cable, the taughtness of which can be adjusted by means of the eye bolt at the end of the bracket. The spread of the curved arms is six inches at their greatest width, and the distance between the centers in which the cable is suspended is two feet. The fittings for this bracket are made of malleable castings to insure greater strength.



Flexible Pole Bracket.

Journal Bearing Alarm.

The journal bearing alarm system of the Electric Heat Alarm Company, Boston, Mass., as illustrated herewith represents the simple method of wiring involved. The thermostat, as shown on the main shaft, consists of a steel cup filled with mercury and kept in position by a non-



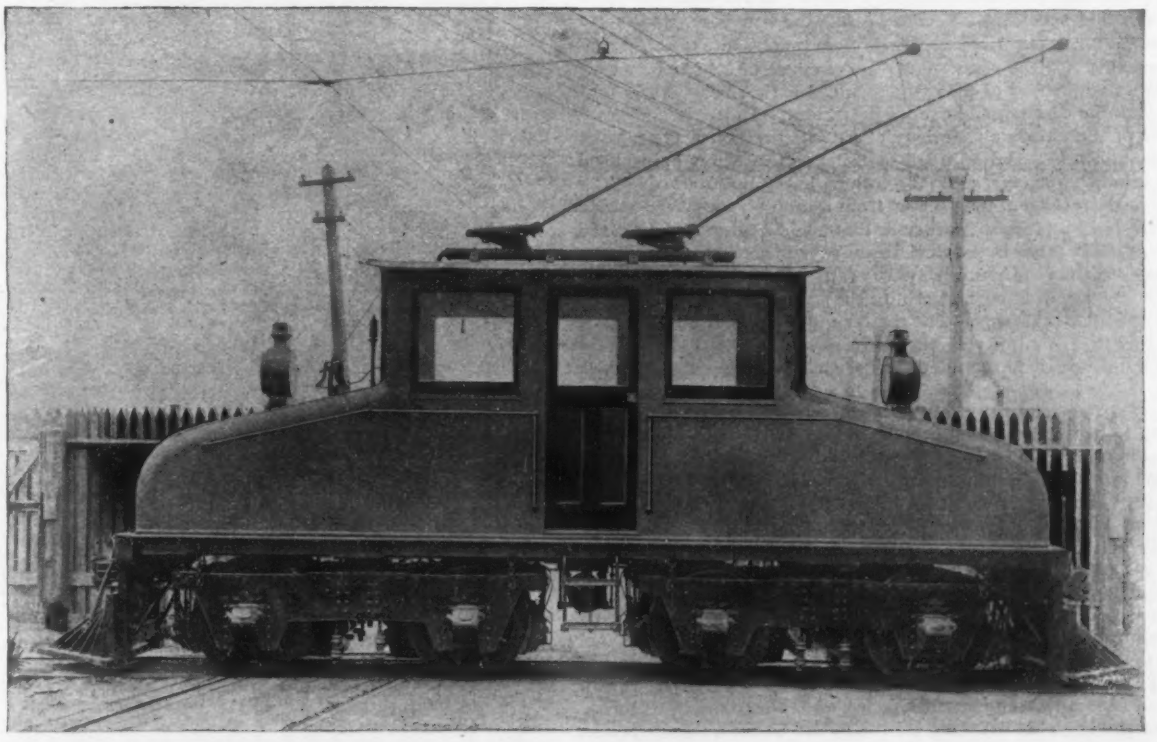
JOURNAL BEARING ALARM.

conducting fibre plug. The screw shown in the centre of this plug is connected by wire to cells of an ordinary open circuit battery, vibrating bell and switch, which constitutes one pole of the circuit. The other pole is attached to the supporting shaft. The thermostat is held in positton by a small metal holder fastened to the cup of the bearing by an 8-32 machine screw. When the bearing near the pulley becomes overheated, the mercury expands and closes the circuit, thus causing the bell to ring the alarm. The attendant throws the switch to stop the ringing of the bell, and then removes the thermostat by slackening the screw shown in cut, and cools the bearing; by the time the bearing is cooled, the thermostat has come to its normal condition and is ready to be placed in holder for another alarm. Through the journal bearing of this company and a switchboard arrangement, any number of shafts can be connected and the heating of the thermostat on any one of them located.

A Forty-Ton Electric Locomotive.

Our readers will recall an interesting description published among our articles on the electrical exhibits at the Chicago Exposition, of a thirty-ton electric locomotive built by the General Electric Company. From thirty tons and one motor truck to forty tons and two motor trucks is but a step, and the General Electric Company has only recently made it. This forty-ton locomotive is now standing in the factory yard at Lynn, and, as will be seen by the illustration, is an imposing looking electrical engine.

It is designed to perform the ordinary work of a steam locomotive of similar capacity where excessive speeds are not requisite, up to about



FORTY-TON ELECTRIC LOCOMOTIVE.

thirty miles an hour. It has two similar but independent trucks, each having four wheels. Each pair of wheels is driven by its own specially designed motor of the single reduction spur geared type, mounted upon the axle as in ordinary street car practice.

The truck frame is constructed of plate iron and channels, designed to obtain at the same time both strength and simplicity. The entire weight of the frame, including the cab, is carried on elliptical springs resting directly on the top of the journal boxes. This suspension

secures easy riding and minimizes the wear both on the locomotive and the truck. The journal boxes are of cast iron with phosphor bronze bearings hydraulically pressed in. Lubrication is provided by means of a large well for oil and waste. The box slides in jaws intended to take up the wear. The journal bearings being outside, all parts are easily accessible for purposes of inspection and repair, and, to ensure against any bending caused by hard usage, the axle and journals are made large.

The cab rests on the truck in a manner somewhat similar to that in which the ordinary passenger car is mounted, an ample margin for wear and strength being provided. The cab itself is constructed of sheet iron and the windows in it are so arranged as to give an almost unobstructed view from one position in all directions. The design of the cab is such as to give plenty of available floor spaces without making the top of the cab long enough to obstruct the sight. The form of the cab also makes a symmetrically shaped locomotive.

The electrical equipment comprises, besides the motors, a series parallel controller, an air compressor, which provides the air for the brakes and whistle, and the automatic safety devices. In addition there are the bells and headlights and sand boxes.

The dimensions of this locomotive are as follows:

Weight	40 tons.
Draw bar pull	14,000 pounds.
Height over all	11 ft. 2 in.
Length over draw bars	24 ft.
Width over all	7 ft. 4 in.
Wheel base of single truck	6 ft.
Diameter of drivers with 3-inch steel tires	40 in.
Number of drivers	8
Size of journals	4½ in. × 8 in.
Gage	4 ft. 8½ in.

Accumulators for Electric Traction and Propulsion.

Those who read the description some months ago in our columns of the operation of three of the street railroads of Paris, France, by chloride accumulators, will be interested to hear that the same battery is now in use operating the street railways of Birmingham, England, replacing the Epstein batteries formerly employed. The Chloride cells operate at least 60 miles on every charge, and could do 80 miles if it were necessary, thus enabling each car to be operated with one set of batteries instead of two as has been the practice heretofore.

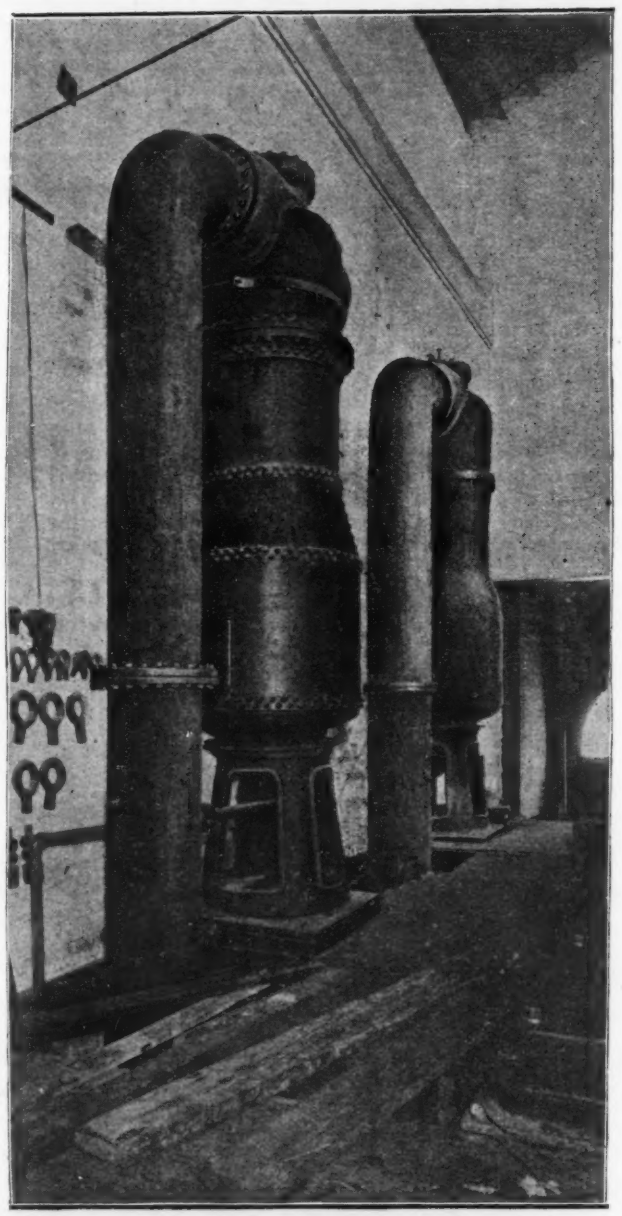
The English company (The Chloride Electrical Storage Syndicate, Limited) has also supplied batteries to Messrs. Mather & Platt for use on the trolley road on the Isle of Man running between Portevada, the Douglas terminus, and the Laxey terminus. At Groudel Glen, situated two and a half miles from Douglas, a battery of 240 cells has been erected in a building specially constructed for the purpose, having a capacity of 140 amperes for three hours, or 70 amperes for nine hours, and are remarkable for the exceedingly level curve of E. M. F. which they maintain up to the end of discharge, and for the very high rate at which they can be discharged without detriment. Half the cells of the battery are of the chloride Company's patent protected type, with teak separators and asbestos diaphragms similar to those now being used on the Birmingham tramways, and the other half unprotected. The cells are charged direct from the line or from a motor generator, which is of special design by Messrs. Mather & Platt, and giving the required additional E. M. F. This is the first instance of accumulators being used as a fixed battery for tramway or railroad work in England, although a similar step has been taken on the Continent in the case of the Zurich-Hirslanden tramway. The battery at Groudel Glen serves not only the function of supplying the extra power required at times of maximum demand, but it is intended during the winter months to work the light cars.

The same English company also recently equipped the electric launch Aphrodite, which has the first equipment of chloride cells used on the Thames. This, launch says an English contemporary, has been specially built in order to demonstrate their superiority for this class of work, their large capacity for a given weight enabling distances and speed to be run without charging, which was previously impossible. The cells with which the Aphrodite is fitted are capable of being discharged at a very high rate, and, on the measured mile, a speed of nine miles per hour has been obtained, and this rate can be continuously maintained for about three hours, which is a record performance for an electric launch of this size; at a slower speed, namely, 6½ miles per hour, which is the usual rate of travel, and which is still considerably above the average speed of electric launches of this size, a day's run of nine hours can be undertaken, inclusive of the time through locks. One feature of the chloride cells referred to by the writer we quote is that although at very high rates of discharge their capacity for a given weight greatly exceeds that of other types, their increased capacity at a low rate is still proportionately greater, and on this account, with the reduced speed of 5½ miles per hour, the battery power with which this launch is provided is capable of covering a distance of approximately 110 miles."

Steam Separators for Power Stations.

The illustration shows two of a total of six Stratton steam separators, all of more than usually large size, recently furnished by the Goubert Manufacturing Company, New York, to the Philadelphia Traction Company for its new power stations at 13th and Mount Vernon streets, and 33d and Market streets, Philadelphia. Two of the separators are 18 inch, two 16 inch and two 8 inch. One of the 18 inch separators is seen in the foreground of the engraving.

The Stratton steam separator is based upon the principle that if a rotative motion is imparted to the steam, all the liquid particles it may contain, being heavier than the steam, acquire centrifugal force and are projected to the outside of the current. It consists of a vertical cylinder with an internal central pipe extending from the top downward, for about half the height of the apparatus, leaving an annular space between the two. A nozzle for the admission of the steam in on one side, the outlet being on the opposite side or on top, as it may be most convenient in making the connections. The lower part of the apparatus is enlarged to form a receiver of considerable capacity, thus providing for a sudden influx of water from the boiler. A suitable opening is tapped



Mammoth Steam Separator.

at the bottom of the apparatus for a drip connection, and a glass water gauge shows the level of the water in the separator at all times.

The current of steam on entering is deflected by a curve partition and thrown tangentially to the annular space at the side near to top of the apparatus. It is thus whirled around with all the velocity of influx, producing the contrifugal action which throws the particles of water against the outer cylinder. These adhere to the surface, so that the water runs down continuously in a thin sheet around the outer shell into the receptacle below, while the steam, following a spiral course to the bottom of the internal pipe, abruptly enters it, and in a now dry condition pgsses upward and out of the separator, without having once crossed the stream of separated water, all danger of the steam taking up again such water after separation being entirely avoided.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, September 1, 1894.

THE ELECTRICAL STOCK MARKET, now that uncertainty relative to tariff legislation has been eliminated from the financial and commercial situation, is beginning to reflect as a whole the impetus that has been given by the cessation of the agitation to all branches of trade. So far as the speculative favorites are concerned, most of the week's development in quotations is due to the work of pool operations, but trade conditions agree fully with the opinions voiced in the last issue of The Electrical World, and quotations are beginning to advance in keeping with the renewed progress toward profit making.

GENERAL ELECTRIC'S quotations hardly bear out these remarks, closing as they do, some two points lower than a week ago. But peculiar causes have combined in this instance to depress values. The stock has been rather freely bought of recent weeks by people who have become acquainted with the good business prospects of the company, and, having paper profits of several points, undertook to realize. There has been, just now, no liquidation of stock, as Wall Street understands liquidation, i. e.: selling out of long stock acquired and bought outright for investment purposes. The small pool that carried the price up on the recent rise was not successful in marketing its stock at the high prices, and, having acquired more stock on the rise than it cared to carry, has been obliged to realize on a good part of its holdings, even at a decline of a point or two. The slump of the last few days has been accompanied, as usual, by adverse rumors. The bears on the property speak of an increase in opposition, competition from Western electric plants being stated to be growing at a rate that threatens serious inroads on the General Electric's business in that quarter. But the company's management insists that its business continues to grow apace. It is announced in one bulletin that it made from the Lynn works this week the largest shipment ever made from any electrical factory, twenty-five loaded cars in a single train having been forwarded, consigned to the General Electric Company, of Portland, Ore. This does not look like poor business, and, if any selling of the stock is being done, it is altogether for the account of the aforementioned pool. No matter what is thought of General Electric stock, the general opinion regarding the debenture 5's is clearly demonstrated by the fact that they are now within a couple of points of par. Rumors are current that the company has been retiring some of the bonds, but this is not in all likelihood so. It is pointed out in an interiew published in the Wall Street Journal that the more logical theory would be to retire a portion of the preferred stock outstanding, nearly $4,251,900. General Electric preferred now sells about 72; this price includes 10½ per cent. accumulated dividends, making the value of the stock but 62, a very low figure for a first lien on all the assets of the company after the debenture bonds, the more so in view of the comparatively high price of the common stock. The movements in the stock, it is pointed out, do not indicate transactions of considerable size, but, nevertheless, the quotations recorded may be used as a basis on which to negotiate private transactions of considerable size.

THE FORT WAYNE ELECTRIC people are making a big noise about the way they are cutting into other companies' fields. Gossip in electrical trade circles is to the effect that the Wenstrom works, recently purchased by the Fort Wayne, have been for sale at a song for the past two years, but electrical experts who have examined the plant and apparatus a number of times have generally found that, while the quality of work is good, the generators and motors made by the Baltimore concern are no better than those of a dozen other makers.

THE SIEMENS-HALSKE COMPANY, of Chicago, backed as it is by tremendous capital and located in the West, where the bulk of new electrical enterprises is arising, it is destined to play an important part in the Western field, hitherto General Electric's own. Its quick re-establishment after its recent fire experiences, shows that it is here to stay, and in the ever-increasing demand for electrical industries, the Siemens-Halske Company will be found to be a competitor that is a powerful factor in the acquisition of electrical contracts.

WESTINGHOUSE ELECTRIC preferred and common stock issues hold their own. Trading in these stocks just now is very limited, but that values do not sag is a good indication of the esteem in which they are held by the trading fraternity. Once the company begins showing what can be accomplished in the way of cheap and efficient product in the new works, renewed interest will be taken in its issues, and values must appreciate. It is announced that interest due to-day on the company's scrip will be paid. Transfer books remain closed till September 4.

THE AMERICAN BELL TELEPHONE COMPANY'S statement as to instrument output furnishes good evidence as to general business conditions. The statement for the month ended August 20, shows a small gross output of telephones, yet 1,528 more than were put out a year ago, when times were at the worst. The returns were larger than the shipments by 842, which compares with net returns of last year of 2,435. Since December 20, 1893, the gross output has been 53,144, the net being 6,164 after deducting instruments returned, a decrease of 18,115, as compared with a year ago. There were in use on August 20 last, 572,655 telephones, a gain over 1893 of 5,656 instruments. This shows that things are picking up again. Stock movements this week have been unimportant; quotations, however, are good.

BROOKLYN EDISON ELECTRIC ILLUMINATING stock is ruling a little higher on small sales. It was bid at 103 during the week on reports of big business. A week ago the station load was within 10 per cent. of what it was last December around Christmas, showing thus how well the company is doing even in the dull summer months. The new system recently adopted by the company to turn arc lights in Brooklyn on and off by means of individual clock work located on each pole, is working very successfully, and is effecting a great saving, as the lights are properly attended to.

WESTERN UNION TELEGRAPH betrays very little life. There has been some selling for bull account and quotations are fractionally lower, but little significance is attached to current movements in the stock.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	10	30
Cleveland General Electric	100	80	90
Detroit Electrical Works	10	3	4
East River Electric Light Co.	100	—	50
Edison Electric Ill., New York	100	98⅓	100
" " " Brooklyn	100	101	102
" " " Boston	100	120	121
" " " Chicago	100	135	145
" " " Philadelphia	100	122	124
Edison Electric Light of Europe	100	1	3
Edison Ore Milling	100	10	15
Electric Construction & Supply Co., com.	15	7⅛	10
" " " " pref.	15	7½	10
Fort Wayne Electric	100	2¾	3
General Electric	100	40	40⅛
Interior Conduit & Ins. Co.	100	45	55
Mount Morris Electric	100	25	50
Westinghouse Consolidated, com.	50	33	34
" " pref	50	52	53
BONDS.			
Edison Electric Ill., New York	1,000	110	111
Edison Electric Light of Europe	194	75	85
General Electric Co., deb. 5's	1,000	94	95
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	200	201
American District Telegraph	100	40	45
American Telegraph & Cable	100	89½	90
Central & South American Telegraph	100	105	110
Commercial Cables	100	125	145
Erie Telephone	—	45¼	46
Gold & Stock Telegraph	100	100	103
Mexican Telegraph	100	185	200
New England Telephone	—	68	69
Western Union Telegraph	100	88¼	89

NEW INCORPORATIONS.

THE PANA TELEPHONE COMPANY, Pana, Ill., has been incorporated with a capital stock of $5,000.

THE ACME ELECTRIC COMPANY, St. Louis, Mo., capital stock $3,000, has been incorporated to manufacture electrical supplies and apparatus.

THE JACKSONVILLE ELECTRIC LIGHT AND POWER COMPANY, Jacksonville, Ill., capital stock $100,000, has been formed by G. D. Staflert S. H. Trude and W. H. Lee.

THE LENOX ELECTRIC COMPANY, Lenox, Mass., capital stock $20,000, has been formed to furnish electric light, heat and power. W. D. Curtis, I. I. Newton and W. D. Bull are the promoters.

THE DETROIT LIGHT AND LAND COMPANY, Detroit, Mich., capital stock $100,000, has been formed to supply light, heat and power. E. G. Holmes, E. D. Holmes, and J. H. Smith, all of Detroit, are interested.

THE HARTFORD ELECTRIC STREET RAILWAY COMPANY, Hartford City, Ind., capital stock $100,000, has been formed to operate a street railway. G. E. Reynolds, A. Reynolds and A. Walker are interested parties.

THE CHICAGO, OAK PARK AND HARLEM STREET RAILWAY COMPANY, Chicago, Ill., capital stock $50,000, has been formed; the incorporators are J. C. Schumacher, J. Guaedinger, G. A. Pudewa, F. Proost and H. D. Schumacher.

THE FARMERS' TELEPHONE COMPANY, Massillon, O., capital stock $10,000, has filled articles of incorporation. The promoters are M. S. Card, N. F. Moffet, J. H. Fisher, Wm. Maxhiemer, A. J.Gordon, F. Segoff, R. A. Perin and A. Short.

THE MORSE ELECTRIC ECONOMY COMPANY, New York, maximum capital stock $5,000,000, has been incorporated to manufacture and sell storage batteries, etc. The promoters are L. Morse, W. F. Herbert and N. L. Phipp, all of Brooklyn.

THE ALTHAM INTERNATIONAL MOTOR COMPANY Portland, Me., capital stock $5,000,000, has been formed to generate, apply and in any other manner use motive power of all kinds. President, Geo. J. Altham, Lawrence; treasurer, Wm. W. Coe, of Somerville, Mass.

THE ELECTRO-MAGNETIC TRACTION COMPANY, Washington, D. C., maximum capital stock $5,000,000, has been formed to build electric motors, gears, street cars, etc. W. M. Stewart, Carson City Nev., P. B. Thompson, Jr., New York, and R. E. Shear, Denver, Col., are interested.

THE ATCHISON RAILWAY, ELECTRIC LIGHT AND POWER COMPANY, Atchison, Kan., capital stock $300,000, has been incorporated by H. O. Odell, G. W. Riggs and A. E. Cullingworth, of Chicago; W. P. Waggenner, E. Engels, C. C. Hetherington and S.E.Harburger, of Atchison, to build an electric street railway and to do a general electrical business.

THE LOCKPORT CITY AND OLCOTT ELECTRIC RAILROAD COMPANY, Albany, N. Y., capital stock $200,000, has been formed to construct a surface electric railway about twenty miles in length. W. T. Holt, M. E. Stone, A. G. Funck, J. I. Toch, E. J. Cunningham, T. J. Agnew, N. Gale, G. E. Dunscombe and F. E. Crasson, of New York City, are the incorporators.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 Broadway, New York, Sept. 1,, 1894.

MR. H. C. WHITNEY has resigned his position with the Interior Conduit and Insulation Co., 44 Broad street, with which he has been connected as motor salesman for the past six months.

H. B. COHO & COMPANY, 203 Broadway, have changed their offices from room 505, Mail & Express Building, to room 511, same building. The new offices are larger and give much better facilities.

LEWIS K. DAVIS, cousnlting and contracting engineer, will move from his

present office at No. 1 Broadway, to the Manhattan Life Building, where he will have commodious quarters and better facilities.

MR. ALBERY A. CARY, of the Abendroth & Root Manufacturing Company, has been seriousy ill for the past few weeks with appendicitis, and was obliged to undergo an operation. He is at present doing nicely, and expects to be out again in a few days.

THE COMMERCIAL CABLE COMPANY'S steamer, the "Mackay-Bennett," on Saturday laid the last four miles of the in-shore line of the new commercial cable, and on Sunday morning landed the end at the shore terminus, pier A, North River.

A CORRECTION—In the last issue of The Electrical World, in the heading to an article on the entrance of the Western Electric Company into the railway field, an unfortunate typographical error transformed the name of the company into the "Western Electric Railway Company." The name of the company is so familiar in the electrical field that we are sure no one could have been misled.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, September 1, 1894.

MR. R. T. M'DONALD, president of the Fort Wayne Electric Corporation, was in the city this week. Notwithstanding the fact that he and N. E. manager, E. I. Garfield, were very busy together, Mr. McDonald found time to greet briefly but kindly many friends and business acquaintances who happened to know of his presence in the city.

MR. C. E. ROBERTS, of the Brown Electric Company, Boston, Mass., and Miss Fannie F. Bird, both residents of Hyde Park, Mass., were united in marriage in that city August 29. Mr. Roberts is one of the electrical "old timers," and his many friends wish for him and his wife all possible happiness and good fortune.

BOSTON, MASS.—Sealed proposals for furnishing the motor generators, switchboards and other appliances required to equip the battery room of the new fire-alarm headquarters on Bristol street will be received at the office of the fire commissioners until 12 o'clock noon, September 8. Plans and specifications can be seen at the office the of Board of Fire Commissioners, Bristol street, Boston. Robert G. Fitch is chairman.

THE BROWN ELECTRIC COMPANY, Boston, reports business as exceedingly good, and well it may, as there is hardly to be found anywhere an abler staff of workers and "hustlers" than it possesses. President Maybin W. Brown is most of the time on the road scooping business and so is his brother "Bert" (who, by the way, has developed into a capital salesman), and Treasurer Philip W. Reynolds, A. H. Holwand, C. H. Pope and C. E. Roberts know just how to look after office details and customers.

Western Notes.

Branch Office of The Electrical World,
936 Monadnock Building, Chicago,
September 1, 1894.

MR. GEO. A. McKINLOCK, president of the Central Electric Company, has returned to Chicago after a few days' recreation.

W. H. M'KINLOCK has returned to his desk after a successful business trip, and reports everything as decidedly on the mend. Business with him is booming just now.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY has closed two contracts during the week for telephone exchanges, one at Columbia, Mo., and another at Palestine, Tex.

P. EDW. SULLIVAN has returned from the Mid-Winter Exposition, where he was electrical inspector of the department, and taken a position with the Jenney Electric Motor Company, at Chicago.

THE CENTRAL ELECTRIC COMPANY intends to push the introduction of Lundell power motors, having made that a separate department, and has sold several important plants within a short period.

THE GILLILAND TELEPHONE COMPANY has succeeded in introducing its telephones in some of the fashionable residences at Lake Geneva. It reports business as very good, and the prospects as bright.

THE METROPOLITAN ELECTRIC COMPANY reports business unusually brisk. Mr. W. H. McKinlock himself is on a short trip, and has, as usual, met with many large orders for the specialties handled by this house.

GEORGE CUTTER sends one of his always welcome reminders on "A Weatherproof Trio," in which he emphasizes some of the good points of "T. Z. R." insulation. Mr. Cutter, as usual, is hustling hard for business.

THE JENNY ELECTRIC MOTOR COMPANY, whose western office was so long presided over by Mr. A. H. Goode, now with the Central Electric Company, was visited last week by President Waples who found quite a number of important matters in connection with prospective sales to attend to. Secretary Jenney was also a Chicago visitor during the week

THE ALLEN SOLDERING STICK seems to maintain no bounds, judging from the sales the Electric Appliance Company is making in all parts of the country. The demand for this specialty in the East is very large and the Electric Appliance Company is shipping sticks in considerable quantities to Boston, New York, Philadelphia and other Eastern points. The Arnold telephone also seems to be satisfying the demand for a first-class magnetic telephone, and many Eastern, as well as large Western, orders have been booked.

News of the Week.

Telegraph and Telephone.

DUBLIN, TEX.—Dr. J. G. O'Brien proposes to put in a telephone exchange, and is in the market for the necessary instruments and apparatus.

PALESTINE, TEX.—L. C. Ketchum has been granted a twenty-five years' franchise for the construction and operation of a telephone system, and he is now in the market for a complete plant.

WASHINGTON, D. C.—Sealed proposals will be received at the Department of the Interior until 3 p. m., September 24, for the construction of a telephone exchange system for the Department. Proposals will also be received for the extension and modification of the present telephone system of the Interior Department. Bids must be addressed to the Chief Clerk, Interior Department.

Electric Light and Power.

CAMBRIDGE, O.—The Council has voted to issue bonds for the establishment of an electric plant.

PAWNEE CITY, NEB.—The city has voted to issue $4,000 in bonds to enlarge the electric light plant.

LAINGSBURG, MICH.—Laingsburg is considering the question of putting in an electric light plant.

HEMPSTEAD, N.Y.—Proposals are wanted until September 17 for lighting the streets of this place with electricity.

GIBSON CITY, ILL.—S. J. Le Fevre will build a brick electric power-house, and add to his present electrical equipment.

JANESVILLE, WIS.—F. M. Marzluff & Co. will erect a three-story 120x44 shoe factory, and an electric light plant will be put in.

INDEPENDENCE, ORE.—A water and electric light company has been formed. Power enough will be generated to light Monmouth also.

RICHMOND, IND.—The Commercial Club has accepted the plans of Oscar Cobb, of Chicago, for a new hotel. An electric light plant will be put in the building.

UNION CITY, MICH.—Union City's common council will call a special election to vote on the question of bonding the village to purchase an electric lighting plant.

ESTHERVILLE IA.—Address N. B. Egbert, City Clerk, in regard to the construction of an electric light plant consisting of thirty arc and 1,000 sixteen c. p. incandescent lights.

LANARK, HILL.—J. T. Valentine is seeking for an electric light franchise.

WEST UNION, IOWA.—Thomas Von Rolf is seeking a franchise to put in an $8,000 electric plant.

JACKSONVILLE, FLA.—Address D. U. Fletcher, Mayor, in regard to the contruction of electric light plant for which the City Council has voted that $75,000 may be expended.

WHITE PLAINS, N. Y.—The sum of $12,000 will be partly spent by the White Plains Gas and Electric Company in putting in a large dynamo, to be ready for use before winter.

STILLWATER, MINN.—The city clerk has been instructed to advertise for bids for lighting the city, equal to the present system of lighting. The present contract expires September 20.

HENRY, ILL.—The plant of the Henry Electric Light Company, with all machinery, was destroyed by fire. Storrett & Sons were the owners. The estimated loss is $10,000 to $15,000.

LEBANON, PA.—R. H. Hammond states that the matter of erecting a city electric light plant had been submitted to the people, and they decided to erect one, but the Council has failed to act.

NEW BRITAIN, CONN.—Chief Johnson recently made an application to the city for a system of electric lights for the city building, and the committee on supplies has decided to put them in at once.

VICKSBURG, MISS.—The City Council will receive bids until October 1, for lighting the city for three or five years with 75 to 100 arc lights. The field for electric lighting is large and would justify an extensive plant.

VAILSBURG, N. J.—The Committee on Lamps presented a contract from the Newark Electic Light and Power Company for lighting the borough with arc lights. The mayor and clerk were authorized to execute the contract.

GALLATIN, TENN.—The indications are that Gallatin will in the near future have an electric light plant. The mayor and aldermen granted a franchise at its last meeting and work will in all probability be commenced at once.

TAYLORSVILLE, KY.—The Taylorsville Milling & Mercantile Company has been organized to erect a dam and establish an electric plant. The capital is $25,000, and those interested are G. S. Wells, Van R. Foroman and O. P. Tichenor.

FT. HOWARD, WIS.—The Ft. Howard council granted David McCartney a franchise to establish an electric light plant. This insures Mr. McCartney's acceptance of the electric street railway franchise and the establishment of both enterprises.

ALLEGHENY, PA.—Sealed proposals will be received at the office of the city comptroller until 2 p. m., Sept. 4, for the construction and erection of boilers, engines, dynamos and electrical appliances for the extension of the electric lighting system.

NEW WHATCOM, WASH.—The City Council has rejected the bid of the Bellingham Bay Improvement Company for electric lighting and has decided to readvertise for 40 lights for a period of two years. The present number is 100 of 2,000 c. p. and the price, $9 each per month.

ERIE, PA.—At a meeting of the common council there was some discussion on the ordinance providing for the increase of the city debt in order to provide for a municipal electric lighting plant. The question will be voted on at the coming November election.

WASHINGTON, D. C.—Superintendent Bernard R. Green, who is also engineer of the construction of the new congressional library, is inviting proposals until September 10, 1894, for furnishing three 125-volt direct coupled dynamos and engines for the library of Congress.

BENTON HARBOR, MICH.—This city is making arrangements to put in an electric plant to light the city and business places for, it is claimed, about one-half now charged by the St. Joseph & Denton Harbor Electric Light Company. It is to be run in connection with the city's water works plant.

JACKSON, TENN.—Sealed propoals will be received until October 2 for furnishing, operating and maintaining forty double-arc 2,000-candle power electric

lamps, with the privilege of fifty at the same price per light, for a term of five years. For specifications, etc., apply to Samuel C. Lancaster, City Engineer.

SUMMIT, N. J.—Jonathan Bonnell, George V. Muchmore, F. E. Dana, and others have petitioned the city to grant the privilege to set poles and string wires over the streets, avenues and highways of the township of Summit, for the purpose of transmitting and distributing current for light and motive power.

CHELSEA, MICH.—The Chelsea Electric Light Company is organized with a paid-up capital of $25,000, to furnish either arc or incandescent lights. Charles H. Davis is president, Archie W. Wilkinnin, vice-president, Frank P. Glazner, treasurer, Fred Wedemeyer, secretary, and A. R. Welch, general manager.

BLACKSTONE, MASS.—At a town meeting a committee was appointed to investigate the subject of electric lighting, with a view to ascertaining the least possible cost for which lights for the streets can be obtained when the present contract with the Woonsocket Electric Lighting & Power Company expires.

GRAND ISLAND, NEB.—The City Council has granted a five years' franchise to the Grand Island Light and Power Company for an incandescent light plant. The company has already filed its acceptance and the promoters started east at once to secure machinery. One thousand lights have already been contracted for.

LINCOLN, MASS.—At regular meeting of the Town Council a petition was presented from the Woonsocket Electric Machine and Power Company, of Woonsocket, R. I., asking for the privilege of running wires for the purpose of distributing electricity for light, power and heat in the village of Manville. The petition was granted.

WASHINGTON, D. C.—Sealed proposals for furnishing and delivering three 125-volt direct coupled dynamos and engines for the Library of Congress building will be received until 2 p. m., September 10. Specifications and further information and blank forms may be obtained on application to Bernard R. Green, superintendent and engineer.

ALTON, ILL.—The Alton Gas & Electric Light Company will enlarge its plant materially. A brick addition will be fitted up with a 125 h. p. boiler, a 200 h. p. Corliss engine and an iron-clad alternator. The capacity of the plant will be increased from 1,500 incandescent lamps to 3,000. The lines over the city will undergo a thorough reconstruction.

JAMESTOWN, N. Y.—The Common Council met for the purpose of discussing and voting on the resolutions pertainig to the proposed extension of the municipal electric light plant. The conclusion arrived at was that the Board of Public Works must prepare new specifications for the improvements to be made and re-advertise for bids for doing the work.

MT. HOLLY, N. J.—The new organization which has leased the Mt. Holly Gas Works, has filed articles of incorporation. It will be known as the New Jersey Gas Improvement Company, capital $100,000. George W. Wright, George W. Schriner, Fred C. Viney are interested. The company will operate gas, electric light and power plants. The main office will be located here.

LANCASTER, O.—Bids will be received by the Board of Trustees of the Boys' Industrial School, at its office near Lancaster, until September 14, for an electric light plant, complete in all details, to be erected in accordance with the plans and specifications adopted by the board and approved by the Governor, copies of which will be furnished upon application. C. D. Hilles is secretary.

O'FALLON, ILL.—A franchise has been granted to the Electric Light, Power, Heat and Waterworks Company for twenty years. The company is composed of the following parties: S. C. Smiley, E. Tiedmann, Phillip Heyde, and Joseph Porter, all of O'Fallon. They are going to put up a first-class plant in every respect. The capacity of the plant will be 30 2,000-candle-power arc lights and 3,000 16-candle power incandescent lamps.

BROOKLYN, N. Y.—Sealed proposals will be received at the office of the Superintendent ot Charities and Correction of Kings county, Brooklyn, N. Y., until 12 m., September 5, for materials for an electric light plant. Each proposal must be accompanied by a certified check, payable to the order of Charles J. Henry, treasurer, or to the amount of 10 per cent. of the aggregate of the bid. A. Simis, Jr., is president and Bernard Lamb, secretary.

WACO, TEX.—Sealed proposals are solicited for furnishing Waco with electric arc lights, incandescent lights and gas lights for public street lighting, for periods of three, five and ten years, of such candle power as required by the specifications adopted by the city. The successful bidder will be required to furnish the site, plant and all appurtenances complete. The city of Waco will furnish nothing but right of way on public streets and grant franchise. C. C. McCullough is mayor.

CHARLESTOWN, MASS.—The Charlestown Navy Yard is to be equipped with an extensive electric lighting plant. An appropriation of between $15,000 and $16,000 for this purpose is now available, and the work of establishing the plant will be commenced at once. The power station will be located in the great machine shop, while lamps will be distributed about the yard, in the workshops, officers' quarters, and the marine barracks. In addition to this, wires will be run to the receiving ship Wabash.

JACKSONVILLE, FLA., expects to have the road to Pablo beach electrically equipped. The City Council have passed the ordinance to build an electric lighting plant for the city lighting, and it needs only the Mayor's signature to be come effective. By agreement the ordinance forbids the city engaging in the sale of lights for commercial purposes, which protects the local gas and electric light company. The new union depot is to be electrically lighted throughout. A special plant will be built and equipped to furnish over 100 arc lights and

WINNIPEG.—It was announced some days ago that a local company was being formed for utilization of the water-power at Rat Portage, in the generation of electric power to be used in the city. All the preliminaries have been completed, and the company is now preparing for operation. This new company will have electric power at Rat Portage of over 50,000 horse-power, and will lay down in Winnipeg power aggregating 5,000 horse-power, which can be increased should the demand require it.

MT. HOLLY, N. J.—The new organization which has leased the Mt. Holly gas works, has filed articles of incorporation. It will be known as the New Jersey Gas Improvement Company, capital stock $100,000, of which the incorporators are George W. Wright, George W. Schriner, Frederick C. Viney and Samuel R. Gaskill. It will not confine its business to Mt. Holly, but will operate gas, electic light and power plants wherever they can be made profitable investments. The main office will be located at Mt. Holly.

AVON, N. Y.—The fact that the streets of Avon are soon to be lighted with electricity is now assured, and operations are to begin towards that end. A company has been formed which will be known as the Avon Electric Company, and is composed of Charles J. Rosendorf and A. E. Young, both of Le Roy, to whom the privilege of placing the poles and stringing the wires throughout the town for that purpose was granted. The firm has already an option, on two building lots, upon one of which a building not less than 30x40 will be erected.

THE ELECTRIC RAILWAY.

NIAGARA FALLS, N. Y.—The Niagara Falls & Buffalo Electric Railway will build a line from Niagara Falls to Buffalo.

HINGHAM, MASS—The charter for the Hanover Street Railway Company was granted the Railroad Commissioners recently.

COLUMBIA, PA.—Another electric railway between Columbia and Lancaster, via Cardelia, Silver Spring and Rohrerstown is projected.

KNOXVILLE, TENN.—Clark Rude and associates have secured a franchise to extend their electric railway on West Main. and other streets.

BALTIMORE, MD.—The Traction Company's new electric line out Edmondson avenue through Calverton to Walbrook has been completed.

MONTREAL, CAN.—The electric motors which the Royal Electric Company has placed on the Curran draw-bridge can turn the bridge in one minute.

PORTLAND, N. Y.—Contractor Jacobs is putting down the electric road in the east end of the village. Poles will soon be erected and trolley wires strung.

LITTLE ROCK, ARK.—H. F. Auton and Messrs. Fuller and Moss have applied to the City Council for a franchise to build four miles of electric railway.

BRIDGEPORT, CONN.—A petition is before the Common Council from the Traction Company, asking for the right to extend its tracks along Barnum avenue.

NARAGANSETT PIER, R. I.—Citizens are agitating the question of an electic road along the shore from the South Ferry, through Narragansett Pier, to Watch Hill.

COATESVILLE, PA.—William B. Given, B. J. McGrann and Senator Patterson are viewing the route as surveyed for the Pennsylvania Traction Company, from Coatesville and Philadelphia.

PHILADELPHIA, PA.—The West Chester and Philadelphia Turnpike Company has secured a charter for an electric road and trolley from Philadelphia to West Chester, with a branch line to Paoli.

NIAGARA FALLS, N. Y.—Mr. Fred Dean has commenced erecting side poles for the trolley railroad to the Devil's Hole, and it is expected that the excavation on the road will soon be under way.

SAYLESVILLE, R. I.—The town council will meet to consider the petition of the Moshassuck Valley Railway Company (Messrs. W. F. & F. C. Sayles) for the right to build and operate an electric railway in Lincoln.

BROCKTON, N. Y—O. P. Howell, the projector of Brockton's proposed electric street railway, says that as soon as residents give him the right of way he will put up a forfeit of $10,000 that the road may be built at once.

AMBLER, PA.—The Borough Council of Ambler has passed on ordinance granting the franchise of the principal streets of the borough to the Ambler Electric Railway Company, which is to extend from Hammondville to Ambler.

SIDNEY, N. Y.—Civil Engineer Eugene F. Musson, with his assistants, Will F. McCulloch, George Gray and Lloyd Shaw, began a preliminary survey of the route of the proposed Butternut Valley Electric Railroad from Sidney to Morris.

LAWRENCE, MASS.—Contractors Soule, Dillingham & Co. have signed a contract with the Lowell, Lawrence & Haverhill Street Railway Co. which calls for the completion of an electric road from Lawrence to Lowell within sixty days.

HARRISON, (P. O. Newark) N. J.—The Newark Passenger Railway Company and the Consolidated Traction Company are authorized to use electric motors as the propelling power of its cars and to erect the necessary poles and string wires.

GLENWOOD, PA.—A new power house is to be erected at Glenwood shortly by the Second Avenue Traction Company, which will supply power to the entire system between Market street and Turtle Creek. It will contain four dynamos of 450 h. p. each.

PELHAMVILLE, N. Y.—The people of Pelhamville are circulating a petition to be sent to the Union Railroad Company, of New York City, requesting that a line be constructed through the village, which will connect Pelhamville with Mt. Vernon and New Rochelle.

NEWTON, MASS.—At a special meeting of the Newton Aldermen the petition of the Newton & Boston Street Railway for a double track on the new Central Boulevard, from the Boston line to Washington street, Auburndale, was referred to the railroad committee.

ST. LOUIS, MO.—The Citizens' Railway Company is preparing to change its motive power from horses to electricity on its line from Kings Highway to Rinkelville. The line will be extended to the limits of St. Louis. C. N. Duffy, 3820 Easton avenue, is secretary.

EASTON, PA.—It is said that the proprietors of the Easton & Bangor Electric Railway Company have determined to build their road as far as Martin's Creek. Engineers have been at work lately in the vicinity of Richmond and Mt. Pleasant surveying for the proposed line.

NEW YORK CITY, N. Y.—The trolley road of the Twenty-third and Twenty-fourth wards proposes to extend its lines all over the district. A line is to run through Tremont avenue from West Farms to Kingsbridge, and through One Hundred and Sixty-first street and Willis avenue.

WORCESTER, MASS.—At a special meeting of the Board of Aldermen the Consolidated Street Railway Company was given a hearing on its petition to extend its double track down Belmont street from Plantation to the lake. The Company was represented by President C. R. Pratt.

GOSHEN, N. Y.—It is believed that arrangements have been made by which the Middletown-Goshen Traction Company will secure an entrance into Goshen. It is proposed that the road shall leave the highway near the Ryerson place on Goshen Hill, and go through the lands of Ryerson farm.

BROOKLYN, N. Y.—The Long Island Traction Company has decided to borrow $3,000,000 for the purpose of adding ninety miles to its present system. Collateral trust notes bearing a face value for this amount will be issued, dated August 1, 1894, to bear interest at 6 per cent. per annum and to mature in three years.

OAKLAND, CAL.—Judge Ogden has granted Receiver Frank J. Woodward, of the Highland Park & Fruitvale Railway, leave to borrow $18,000 on his certificates for the purpose of extending the line of the road from Thirteenth avenue and Eleventh street, in East Oakland, to Jefferson street, in Central Oakland.

HARTFORD, CONN.—The directors of the Hartford, Manchester & Rockville Tramway Company awarded the contract for building its line from the terminus of the Hartford Street Railway Company, in Burnside, to the Main street railway crossing, in Manchester, to George U. Vaughn and Fred P. Lay, of Springfield.

RUTHERFORD, N. J.—Delos E. Culver, representing the proposed electric railway from Rutherford to Newark, went before the Rutherford Borough Council and asked permission to submit a proposed ordinance giving the railway right of way through Park avenue, Rutherford. Permission to submit the ordinance was granted.

PHILADELPHIA, PA.—The Board of Highway Supervisors has received an application from the Market street, Richmond & Frankford Elevated Railway Company for permission to begin work north and northwest from Penn street and the Oxford turnpike to Cheltenham. The matter was referred to a committee, with power to act.

BALTIMORE, MD.—The Baltimore, Middle River & Sparrow's Point Railroad Company will apply to Baltimore County authorities for additional privileges. It intends building an electric railroad to Sparrow's Point. The incorporators are George R. Willis, J. Sloan Haskins, Thomas B. Gatch, Levin F. Morris and John J. Forrester.

WESTMINSTER, MD.—The Westminster & Union Mills Electric Railway Company, lately noted as chartered to build an electrical railroad from Westminster to Union Mills, has organized with T. Herbert Shriver, of Union Mills, president, Charles E. Stewart, vice-president, William B. Thomas, treasurer, and Charles H. Vandeford, secretary.

SAVANNAH, GA.—Applications for an injunction and a receiver for the electric railway company of Savannah, Ga., has been filed. This company defaulted on its bonded interest in July and with the recent rate-cutting and competition with the city and suburban railway, has lost considerable money. There is little doubt but that a receiver will be appointed.

HAMILTON, O.—The Dayton, Cincinnati & Middletown Electric Traction Co. will at once proceed with the construction of its electric road between Cincinnati and Hamilton. Mr. W. C. Shepherd, of Hamilton, the company's attorney, says that the road will be completed by the first of January. The City Council will be asked for the right of way through Hamilton.

M'KEESPORT, PA.—A special meeting of the McKeesport & Versailles Cemetery Board has considered favorably the proposition of the McKeesport Railway Company to obtain ten feet of the cemetery ground along the stone retaining wall on Fifth avenue, as a right-of-way for its line to enter this city, and to reach the Baltimore and Ohio Railway depot by way of Jerome street.

PITTSBURGH, PA.—R. L. McCully, the engineer who had charge of the Pittsburgh & Mt. Lebanon Electric Railway, has completed the work, and the company will commence to lay the tracks immediately. The railway will run from the head of the Monongahela incline down to Grandview avenue to Scott, to Shannon, to Essex, and to Bridgeville. It will require about $100,000 to build the line.

CHARLOTTESVILLE, VA.—The City Council has granted an extension of the franchise to the Piedmont Improvement and Construction Company to build an electric car line in the principal streets of this city. Work will begin immediately. The president of the company is Hon. Joseph E. Willard; Capt. T. O. Troy is general manager, and the secretary and treasurer is Joseph E. Willard.

MEDIA, PA.—The Media, Middletown, Aston & Chester Trolley Company, which has been almost a year trying to get through Chester Township, commenced operations, the company having given the contract for surveying to Engineer Howland, who commenced work on August 23. Mr. Howland will make a complete set of plans, which can be used in the construction of the road, but they will first be used for getting estimates of the cost of the line.

WILLOW GROVE, PA.—The State Department at Harrisburg, has issued a charter to the Willow Grove & Hatboro Street Railway Company, capital $18,000. The line will run on the Hatboro and Warminster turnpike from its intersection at Willow Grove, to the line between Bucks and Montgomery Counties. The president is John H. Fow, of Philadelphia; directors, Arthur D. Markley, Samuel J. Garner, James Van Horn, O. F. C. Robinson and others, of Willow Grove.

WASHINGTON, D. C.—Preliminary drawings are being made by Engineer Wm. J. Upton and Architect W. B. Wood for a power house and a car barn for the Columbia Railroad Company, to be located in the immediate vicinity of the company's present office and stables. The power house will be of brick, one story and basement, 200x80, and will contain engine room, boiler room, oil and coal room. Steel trusses and an iron roof will be the features. The front part of the building will be spanned with an 80-foot truss and the back with two trusses, one 18 and the other 32 feet. The car house will be of brick, 125x200, and will contain the offices. No contracts have been let.

CAMDEN, N. J.—The West Jersey Traction Company is composed of Camden and Philadelphia capitalists, who have extensive plans for a trolley system which will connect all the towns along the Delaware River, from Burlington down to Camden. It owns a majority of the stock of the Haddonfield Turnpike Company, and now has a force of men at work building a trolley line from Camden through Collingswood to Haddonfield. They have also projected a line from Camden to Merchantville, Pensaukin and Moorestown. The company proposes to run its lines through Camden to the Kaighn's Point and Market street ferries, and also crosstown lines. This matter will be considered by the Camden City Council.

STROUDSBURG, PA.—Work has been started on the Delaware Valley Electric Railroad from Stroudsburg to Port Jervis, a distance of forty miles. This road runs through Pike county, Pa., and will be an important feeder to the D., L. & W. R. R., the N. Y., L. E. & W. R. R., and the N. Y., S. & W. R. R. The work is in charge of Charles E. Hague, of Philadelphia, as general manager, ably assisted by H. F. Sanville, as electrician, and assistant manager. The office of the company is at East Stroudsburg, where a corps of able engineers are busily working under the direction and supervision of Stewart Kennedy, C. E. The company is about closing orders for apparatus, orders having been placed for rails, ties, etc.

SOUTH ORANGE, N. J.—The Village Improvement Society is making a commendable effort to secure the benefits of an electric road without its disadvantages. A line from Orange is projected, but the people of South Orange are unwilling to give it entrance into their village by any of the residence streets or allow a new street to be laid out through the low lands, which would only result in the spoiling of their beautiful valley by the cheap class of buildings which would be sure to follow the route. The village is seeking to solve the question by compelling the railway company which receives the franchise to convert the lowlands into a park and run its road as a private way, fenced in and avoiding grade crossings. This would give a chance for very high speeds.

MERCED CAL.—A Chicago syndicate proposes to build an electric railway from Merced into the Great Yosemite Valley. It guarantees to build the road from Merced and to furnish the city of Merced with 1000 electrical horse-power if said city will bond itself for two hundred thousand dollars in their favor. The first power station would be about twenty-five miles distant from Merced, utilizing the water power of the Merced River, which rises in the Yosemite Valley. The railroad will run along the south bank of the river into the Valley, and the power stations placed at convenient locations along the river, utilizing the water power of the river at each station. The distance from Merced into the Yosemite Valley by this route is about sixty miles. Such a railroad would develop many valuable industries. It taps the great timber belt of the Sierra Nevada Mountains. It passes great mountains of solid granite and marble. It is in close proximity to the great gold mines of Mariposa County, and crosses the great "Mother Lode." Many of the low grade mines can be profitably worked by electricity that cannot be worked by steam. The road is over a most picturesque route all the way from the great San Joaquin Valley into the high Sierras. Tourists will thus be able to view the valley in winter as well as in summer by a most delightful and rapid route.

Personal Notes.

MR. E. ARNOLD, whose name is familiar to the readers of The Electrical World, and who was formerly one of the engineers of the Oerlikon Works, has been appointed professor of electricity at the Technical High School at Carlsruhe.

LORD KELVIN has been awarded the Societe d'Encouragement grand gold medal for 1894. This medal is awarded to Frenchmen or foreigners whose labors have had the greatest influence during the preceding six years on the progress of French industry.

MR. C. H. CHALMERS, of St. Paul, Minn., we learn, was the author of the excellent paper on "The Modern Dynamo" read at the St. Paul Convention of the Northwestern Electrical Association, and which in our columns was credited to Mr. Gilbert Donaldson. We regret this error, which was copied from the stenographic report of the Convention.

Trade and Industrial Notes.

THE AUTOMATIC ELECTRIC REGULATOR COMPANY, Lowell, Mich., has been formed to manufacture an electric governor. Mr. C. S. English is the electrical engineer of the company.

THE ACME FILTER COMPANY, of St. Louis, has issued a very neat and readable leaflet on its oil filter, in which is given a long list of the electrical plants where this clever and useful device is in service.

THE GOUBERT MANUFACTURING COMPANY, New York, besides the Stratton separators described elsewhere, has also supplied Goubert feed water heaters of the latest improved type for the new plant of the Philadelphia Traction Company, aggregating 12,000 horse-power.

THE D. F. SWEET ELECTRICAL MANUFACTURING COMPANY, of Grand Rapids, Mich., has placep onthemarket a new and improved "Limit Switch," designed for motor circuits, and which acts at once as a switch and fuse plug. It is meeting with great favor, and will soon be seen in different sections of the country.

THE UNION METALLIC CARTRIDGE COMPANY, of Bridgeport, Conn., has placed the order for three large buildings with the Berlin Iron Bridge Co., of East Berlin, Conn. The Larchmont Electric Company, of Mamaroneck, N. Y., has also placed the contract of its power station with the Berlin Iron Bridge Company. The building will be 50 ft. wide and 90 ft. long.

THE PHOSPHOR-BRONZE SMELTING COMPANY, Limited, 2200 Washington avenue, Philadelphia, has issued price list No. 9 of its products, which include wire from No. 4-0 to No. 36, and of round, flat and square sections. There are also lists of telephone and telegraph phosphor-bronze wire, phosphor-bronze alloys for castings, bearings and plates, and rods of metal for various purposes.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, O., has nearly completed its new factory addition which will increase the daily output to from six to eight thousand lamps. With its ability to manufacture at low cost, and the high reputation already achieved for the special coiled filament lamp, they say the "Buckeye" will be hustled into central stations and isolated plants in a lively manner.

THE ATLAS ENGINE WORKS, Indianapolis, Ind., of which Edward P. Hampson & Co., 36 Cortlandt street, New York, are agent have issued a large-

page catalogue of their steam engines and boilers. The catalogue is tastefully gotten up and well-printed on paper of extra quality. Many forms of horizontal engines are illustrated, of which we note in particular several types of automatic heavy-duty engines. A number of types of stationary and portable boilers are also shown.

THE D'UNGER LONG-DISTANCE TELEPHONE COMPANY, of Chicago, Ill., in a recent communication state that one of their instruments, which was in use every day except Sunday for four years, transmitted speech more clearly when taken down than the day it was put up, and was never touched during that time, save to charge the cell. In explaination of this the D'Unger Company claim that no self-cleaning, voice strengthening or voice wave reducing telephone can be made without a lever, to the use of which the company claims the sole right

THE OHIO BRASS CO. Mansfield, Ohio, is gratified that the superior workmanship and quality of the metal employed in the manufacture of its railway motor bearings are receiving due appreciation and resulting in a large increase of sales, its patrons including many of the largest roads in the country. These bearings are made of guaranteed bell metal, and are turned and trued up, and milled by special machines lately installed for this purpose. The extraordinary care taken with the finish of these insures a perfect fit, and an even and smooth bearing for the shaft.

A CORRECTION.—In our issue of Aug. 18, page 164, the statement was made that Henry R. Worthington had placed an order through Manning, Maxwell & Moore for a Shaw electric traveling crane, this crane to supplement an electric crane of another make. We are advised by the Morgan Engineering Company, of Alliance, O., that the crane ordered from the Shaw Company did not supplement a Morgan crane or, in fact, any crane, as the following extract from a letter received by the Morgan Engineering Company from Charles C. Worthington, President of the Henry R. Worthington Hydraulic Works: "The crane we recently ordered of the Shaw Company is to be used in our loam foundry. The crane you built for us is at work in our green sand foundry, which is a separate building. Your crane is doing good work, and we have no complaints to make of its performance."

CHAS. E. GREGORY & CO., 47 & 49 S. Jefferson street, Chicago, Ill., report the following list of recent trade sales: Schneider Co., Garner, Ia., one 60-light United States plant; Rud. Lafferty, Chicago, one 1 h. p. C & C arc motor; Gardner-Morgan Electrc Company, Chicago, one 10 h. p. Detroit motor; J. W. Alber, Chicago, one 10 h. p. Crocker-Wheeler motor; Crane Elevator Company, Chicago, one 25 kw. Westinghouse motor; C. C. Travis, Lavon, Ill., one 100-light Excelsior dynamo; Wilson & Jackson, Chicago, one 8-light arc plant, one 10 h. p. engine; C. R. Celaghorn, Conemaugh, Penn., one 5 h. p. Crocker-Wheeler motor; R. Roach, Chicago, one 210-light Edison dynamo; Garibaldi & Cuneo, Chicago, h. p. C & C motor; Seeger, Guernsey & Company, one City of Mexico, Mexico, one 50-light U. S. dynamo, one 100-light U. S. dynamo, and one 10 h. p. Crocker-Wheeler motor; Geo. Cutter, Chicago, one 1 h. p. Crocker-Wheeler motor, one 450-light dynamo; Pontiac E.L. H. & P. Company, Pontiac, Ill., one ½ h. p. motor; Jorden Show Printing Company, Chicago, one 10 h. p. Edison motor; Capt. E. E. Napier, Steamer Mactawa, one 5-light Sperry arc plant; Plamondon Mfg. Company, Chicago, one 60-light United States plant; C. Shotte, Chicago, one 2,000-light Edison dynamo; Hatch Cutlery Co., Buchanan, Mich., one 25 kw. Edison motor; University of Colorado, Boulder, Col., one 100-light United States plant; Northwest Fixture Company, Seattle, Wash., one 5 h. p. Sprague motor; Tuscaloosa Gas & Electric Light Company, Tuscaloosa, Ala., one 100-light U. S.; Champaign & Urbana Railway Company, Champaign, Ill., one 10 h. p. T. H. motor; Tappan Steam Pump Company, Chicago, one 6 h. p. Crocker-Wheeler motor; Crane Elevator Company, one 1 h. p. Crocker-Wheeler motor; Windemere Hotel, Chicago, one 3 h. p. Sprague motor; D. S. Huff, Morris, Ill., one 50-light U. S. dynamo; Charleston T. H. Electric Company, Charleston, Ill., one 1 h. p. Crocker-Wheeler; Receivers of the Penn. Steel Company, Steelton, Pa., 16 Standard arc lamps; Kug, Nathan & Fischer, Chicago, two Ward arc lamps; Elmer P. Morris, Indianapolis, Ind., six Ward arc lamps; Robbins Electric Company, Pittsburg, Pa., four Edison arc lamps.

THE MATHER ELECTRIC COMPANY, Manchester, Conn., reports a marked and very satisfactory increase in orders since the passing of the new tariff bill was perfectly assured. Its sales for lighting apparatus, alone since then are as follows: New Davidson Theatre, Milwaukee, two 1,000-light dynamos; A. W. Perry, Boston, Mass. (fifth order), 350-light one dynamo; Hotel Minot, New York City, one 650-light dynamo; Hoboken Quartet Club, Hoboken, N. J., one 150-light dynamo; Henry Reinhardt; New York City, one 100-light dynamo; E. P. Gleason Manufacturing Company, New York City, one 250-light dynamo; Pisataqua Woolen Company, Guilford, Me., one 600-light dynamo; Danvers Insane Asylum, Danvers, Mass., one 250-light dynamo; Newport Gas Light Company, Newport, R. I., one 250-light dynamo; State Almshouse, Tewksbury, Mass., one 600-light dynamo; Whittenton Manufacturing Company, Taunton, Mass., one 100-light dynamo; Weise Bros., Moline, Ill., one 250-light dynamo; Chambers Electric Light and Power Company, Truro, N. S., one 500 light dynamo; Union Central Life Insurance Building, Buffalo (third order), one 250-light dynamo; Beck Brewing Company, Buffalo, N. Y., one 600-light dynamo; Comstock Construction Company, Chicago, Ill., one 250-light dynamo; Gallagher Bros., Meridian, Miss. (third order), one 100-light dynamo; New Ford's Opera House, Washington, D. C., one 450-light dynamo; Jones Bros.' Electric Company, Cincinnati, O. (seventh order), one 50-h. p., 220-volt generator; New Pittsburg Coal Company, New Pittsburg, O., one 60-kw. 220-volt generator; Morris Coal Company, Sand Run, O., one 60-kw. 220-volt generator; Harry S. Smith & Company, Philadelphia, Pa., two 45-kw, direct connected generators; J. Holt Gates, Chicago, Ill., one 250-light dynamo; J. Holt Gates, Chicago, Ill., two 60-kw, belted generators; J. Holt Gates, Chicago, Ill., one 60-kw, direct connected generator. The Mather Company also reports a very large sale of its new Manchester type slow speed stationary motors, in sizes from 3 to 50 h. p. It has had so much success in the introduction of these motors that it has so far been unable to keep up with its orders for this class of apparatus.

Business Notices.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

WHAT WILL THE NEW YORK CENTRAL DO NEXT?—After having his thirst whetted, like a tiger by the taste of blood, by the wonderful performances of Engine No. 999, the genie who presides over the transportation department of the New York Central Railroad is rampant again, and laboring persistently to find means of attaining the speed of lightning. He is at work in his cell, by stealth and at midnight, and before many moons have passed we expect to see a terrible apparition coming up the Hudson River like the war chariot of Jove. We may expect a monster engine, with double boilers of enormous power and wheels as tall as a shot tower, which will trot up to Albany in an hour, skip over to Utica or Syracuse at half an hour schedules and cover the distance from New York to Buffalo in threee hours. Then we shall need some means of artificial respiration.—Medford (Mass.) "Mercury."

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUGUST 28, 1894.

(In charge of Wm. A. Rosenbaum, 177 Times Building, New York.)

525,001. INSULATOR; Leonard W. Bradley, Cleveland, O. Application filed February 13, 1894. An insulator composed of two parts, each part being provided with a central screw passage and the meeting faces of said parts having coinciding grooves which begin on approximately straight lines near the edges and curve near the centre of the parts to avoid the central aperture; the walls of said grooves being adapted to engage the upper and lower portions respectively of the electric wire and hold it firmly and prevent it from slipping longitudinally.

525,007. MANUFACTURE OF CARBON FILAMENTS; Thomas A. Edison, Llewellyn Park, N. J. Application filed December 15, 1886. The method of making filaments for incandescent electric lamps, which consists in forming a core of a substance soluble in water, coating the core with one or more layers of carbonizable material, dissolving the core in water and finally carbonizing the hollow filament.

525,013. FEED ALARM FOR CARDING MACHINES; William W. Gordon, Hazardville, and Thomas F. Pye, of Hartford, Conn. Application filed August 26, 1893. In combination in a carding or like machine, an electric alarm, a push button for controlling the electric current, a swinging lever adapted to operate the button, a receiver having a pivoted feed board, and a connecting mechanism between the lever and feed board whereby the former is caused to engage the button and sound the alarm.

525,015. TROLLEY. Naaman W. Haskins, Brooklyn, N. Y. Application filed December 1, 1893. A trolley for engagement with a single electric conductor consisting of a plurality of grooved annular bearings formed at right angles to a common axis, the side walls of each groove, forming a separate bearing capable of transmitting the current to an electrical conductor common to all the flanges.

525,016. TROLLEY-WIRE SWITCH AND CROSSING; Naaman W. Haskins, Brooklyn, N. Y. Application filed April 23, 1894. In combination with a trolley consisting of a plurality of grooved annular bearings, an electrical conductor for trolley lines formed with notches or grooves at or adjoining its intersection with a similar conductor, said notches or grooves coinciding in position with the paths of the several flanges upon the said trolley.

525,017. STORAGE BATTERY; Henry K. Hess, Syracuse, N. Y. Application filed October 11, 1892. In a battery, the combination with a conducting frame or grid, and separated layers of active material applied to said conducting frame or grid, of a layer of quartz-sand interposed between the layers of the active material, and having the separate grains or particles thereof held together by non-electric-conducting adhesive material, layers of non-electric-conducting porous material at the outside of the layers of active material, and layers of quartz-sand at the outside of said layers of non-electric-conducting porous material, and having the separate grains or particles thereof held together by non-electric-conducting adhesive material.

525,018 STORAGE BATTERY; Henry K. Hess, of Syracuse N. Y. Application filed February 13, 1893. In a storage battery, the combination with a body of active material: of a pair of perforated electric conductors arranged on opposite sides of said body of active material, and electrically connected thereto, and a non-electric conducting material arranged in the perforations of the electric-conductors and consisting of quartz sand having its separate grains or particles held together by a non-electric-conducting material.

525,020. ELECTRICAL FIRE ALARM APPARATUS; Ernst Waldemar Jungner, Stockholm, Sweden. Application filed November 8, 1893. In thermo electric fire alarm the combination with a normally closed thermo-electric-circuit, a relay therein composed of four solenoids arranged in pairs and provided with tubular glass cores, and a normally interrupted signalling circuit, of circuit closing devices comprising a fixed contact connected with one of the terminals of the signal circuit, a pair of magnets projecting into the cores of oppositely arranged solenoids a support for said magnets suspended freely between the solenoids, and a contact on said support connected with the other terminal of the signalling circuit and adapted to co-operate with the aforesaid fixed contact to close said circuit when the magnet support is vibrated by current passing through the solenoids.

525,034. ELECTRIC ARC LAMP; Elihu Thomson, Lynn, Mass. Application filed January 24, 1894. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil, and the spring, a circuit controlled by the con-

tact, a magnet in such circuit, and a detent actuated by the magnet, such detent controlling the feed of the electrode.

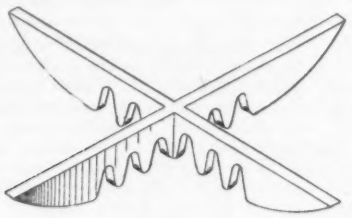
525,035. ELECTRIC ARC LAMP; Elihu Thomson, Swamscott, Mass. Application filed May 16, 1894. In an electric arc lamp, a series coil, a core for such coil, a second coil in inductive relation to the series coil, a magnet in the circuit of such second coil, a detent actuated by the magnet, a frame connected to the core of the series coil and containing the gearing, a rack-rod meshing with the gearing, and a contact actuated by the movement of the core or frame and arranged and adapted to complete the circuit through the second coil upon the descent of the core.

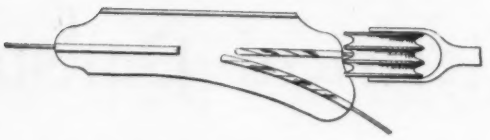
525,037. MEANS FOR LIMITING THE TENSION OF DRIVING SPRINGS; Paul Wendelobe, New York, N. Y. Application filed February 27, 1894. In a printing telegraph or other clockwork instrument, the combination of a driving spring, a step by-step mechanism for winding the same, and detent devices therefore provided with a resilient member arranged to give whenever the driving-spring exerts the greater power.

525,082. TRAIN ROBBER ALARM; Max S. Levy, Kansas City, Mo. Application filed March 27, 1894. In a train-robber alarm, the combination with a vertically movable platform in the engine cab, catches depending from the floor of the cab, and a sliding frame carried by and normally supporting the movable platform in its raised position by engaging the said catches, of spring-pressed doors, and bells, located in the various cars, electro-magnets adjacent to said doors and bells, electrical conductors, and means to operate the sliding frame and disengaging the same from said catches, allow said platform to move downward, and thereby cause the completion of an electrical circuit to energize the electro-magnets to allow the doors to operate, and to sound the alarm.

525,108. ELECTRIC-MOTOR; Abraham V. Meserole, New York, N. Y. Application filed January 8, 1894. In an electric motor, a fixed drum-shaped field ring having an odd number of coils exceeding by at least three the number of the armature poles and electrically connected in series, in combination with a bi-polar armature rotating within said field ring and having crescent-shaped pole extensions.

525,134. CIRCUIT-BREAKER; Cumings C. Chesney, Pittsfield, Mass Application filed July 6, 1894. The combination with the terminal plates or contacts of an electric circuit, of a pivoted bride-piece adapted to be forced and maintained in engagement with said terminals, a pivoted weight engaging with the bridge-piece but having a determined range of movement independent of the same, and a tripping device for holding the weight in an elevated position against the force of gravity.





No. 525,016.—Trolley Wire Switch and Crossing.

525,145. ELECTRO-MAGNETIC CALL BELL; John J. Geary, Chester, Pa. Application filed January 26, 1894. An electro-magnetic signalling device, comprising a housing or frame having a bell supported free thereof, an electro-magnet, a spring supported armature projecting through said housing and provided with an adjustable hammer or sounder, a detachable insulated block having binding posts and a circuit-breaking point adapted to contact with the free end of the spring of said armature, and a battery circuit connected with the binding posts of said insulating block.

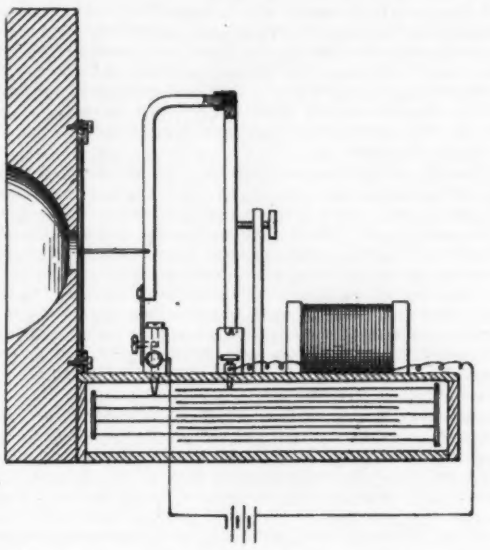
525,169. ELECTRIC BELL; Richard Varley, Jr., Englewood, N. J. Application filed September 21, 1893. An electrode having a contact point, in combination with the second electrode and a septum, and a clamp for securing the septum around its edges, there being a hole through the septum for the passage of the contact point, so that both electrodes are within the cavity inclosed by the septum.

525,201. TELEPHONE TRANSMITTER; John Goodman and Henry M. Goodman, Louisville, Ky. Application filed May 1, 1894. A telephone transmitter, consisting essentially of two magnets having their opposite poles opposed to each other, a mass of magnetic material in a comminuted state between such poles, and a vibratory diaphragm connected with one of said magnets, the movable magnet being mechanically related to the diaphragm upon the principle of a lever, whereby the movements of said magnet may be augmented or diminished relatively to the movements of the diaphragm.

525,235. DRY BATTERY; John I. Solomon, New York, N. Y. Application filed April 11, 1894. In a dry battery, the combination of a cell made of glass, a curved plate of zinc within the cell, a carbon rod inserted in the cell within the curved zinc plate and provided with a thick coating formed of a mixture of black oxide of manganese, granulated carbon and chloride of zinc, a granular porous filling placed within and around the zinc plate and around the carbon rod, a seal closing the top of the jar and surrounding the carbon rod, a wire leading through the seal to the zinc plate, and a ventilaitng tube passing through the seal to the porous filling.

525,266. CIRCUIT CLOSING DEVICE; John J. Geary, Chester, Pa. Application filed February 5, 1894. The combination with a recessed member and a hinged member of a device provided with metallic and insulating plates, plugs or disks and strips and binding screws, a push, stem or rod adjustably seating with a helical or coiled spring, a contact provided with a split helix or ring detachably engaging said spring and having flaring metal arms and a battery circuit provided with an audible signal device.

525,290. ELECTRICAL RAILROAD SIGNAL; William F. Seymour, Mansfield, O. Application filed June 30, 1894. The combination with the rails of a track at a crossing, of feed wires connected at their ends to said rails a limited distance at each side of the crossing, connecting wires connecting said feed wires with the respective rails at the joints thereof, a post at the

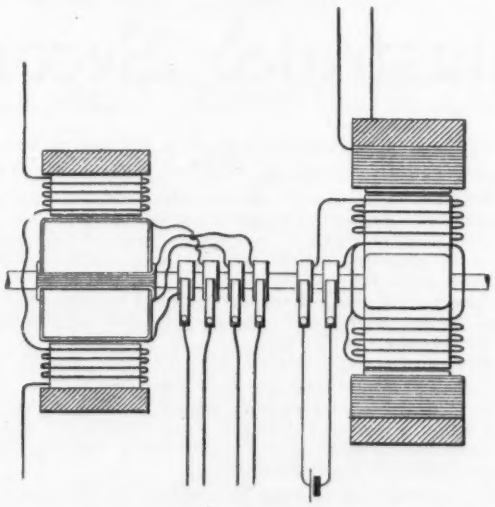


No. 525,201.—Telephone Transmitter.

crossing, a bell on said post, a bracket secured to the post, a battery on said bracket, and wires connecting said bell and battery in circuit with said feed wires.

525,291. ELECTRIC ALARM LOCK; John Slater, Hutchins, Pa. Application filed November 9, 1893. An alarm lock having an actuating spindle with a lug which projects therefrom, a bolt adapted to be moved by said lug and spindle, together with pivoted plates having intermeshing teeth, said plates being connected to a binding post and adapted to contact with a plate insulated therefrom and attached to another binding post.

525,293. INCANDESCENT ELECTRIC LAMP CUT-OUT; Walter F. Smith, Philadelphia, Pa. Application filed August 23, 1889. In an incandescent electric lamp, a shunt circuit, a substance of high electrical resistance



No. 525,312.—Apparatus for Changing Period and Phase of Alternating Currents.

readily melting or softening interposed in said circuit, a movable pin contacting with said substance and a lever held in contact with said pin and short circulating the lamp by the melting or softening of said substance.

525,312. METHOD OF AN APPARATUS FOR CHANGING PERIOD AND PHASE OF ALTERNATNG CURRENTS; Charles S. Bradley, Avon, N. Y. Application filed July 10, 1893. Method of altering the frequency of an alternating current consisting in creating an alternating magnetic field by such current, and rotating in said field a conductor or circuit so as to pass its poles at a fractional part of the rate of the alternating current.

525,315. ROSETTE FOR ELECTRIC LIGHT WIRES; David J. Cartwright, Boston, Mass. A rosette having an internal chamber, a central hole through which the lamp cord passes to the said internal chamber, a hole or opening, a slot connecting the holes, the inner end of the hole or opening being slightly enlarged, and a raised ring at the inner end of said hole.